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CHEMICAL & METALLURGICAL ENGINEERING

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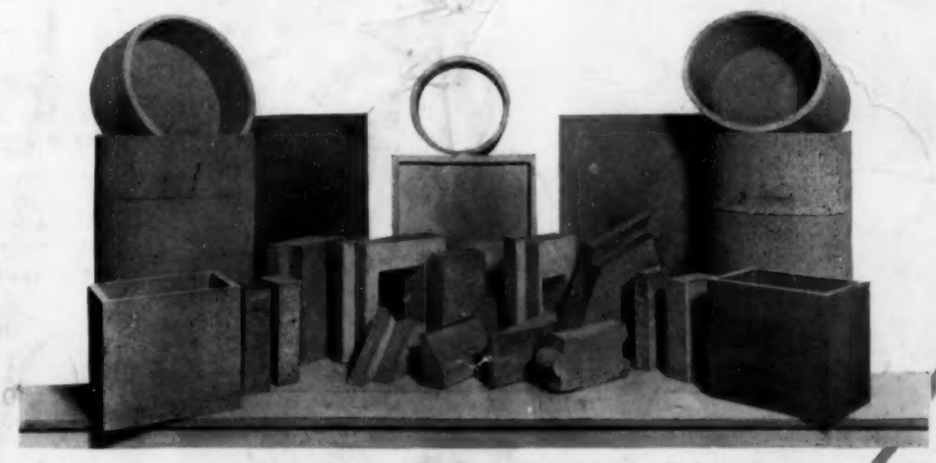

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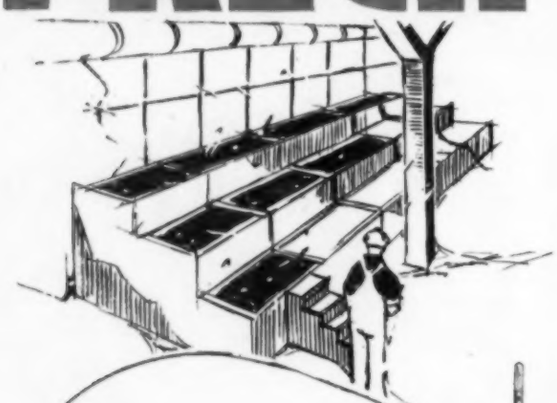

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CHEMICAL & METALLURGICAL ENGINEERING

McGRAW-HILL COMPANY, INC.
JAMES H. McGRAW, *President*
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H. C. PARMELEE
Editor

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Chem. & Met. To Be Published Monthly

WITH this issue "Chem. & Met." will discontinue weekly publication, and with the March number will become a monthly magazine published on the 15th of each month. The editorial direction and policy of the paper will remain unchanged and its editorial quality will continue to be of the high order that has already gained for it acknowledged leadership in its field and placed it in the forefront of business papers.

Its primary purpose will be, as heretofore, to discuss the fundamental principles underlying technical processes and to illustrate their practical application for efficient production in that wide range of industries comprehended in the term "chemical engineering industries" or "process industries." Service to the technical and production man will be kept constantly in view and will be steadily improved as time and opportunity afford. Progress will be recorded while it is yet fresh. New products and processes will be described and illustrated so that the reader can adapt them to his own peculiar needs. In short, the magazine will be a clearing house for ideas that can be applied to economical and efficient production, edited from the field and in close contact with industry.

The other features of the paper will be maintained and strengthened. Obviously the industrial news and market sections will take on monthly rather than weekly characteristics, but they will be no less valuable to the executive who must keep abreast of events and follow the trend of the chemical and raw material markets. New economic and statistical studies will be presented that should prove useful aids in more effective control of production and consumption. A review of commercial developments, new construction and industrial expansion will prove an invaluable guide to business conditions in the chemical and related industries.

WE KNOW from our contact with the readers that the change in frequency of publication of "Chem. & Met." will meet their approval; it will also give the editors an opportunity for more critical selection and preparation of material. Weekly publication was inaugurated in the fall of 1919 at the height of post-war activity in the chemical and chemical engineering industries. Events were then moving in swift succession and new developments pressed for publication. Progress was rapid and could not be satisfactorily recorded in a monthly magazine. But for the present, with our industries more firmly established in competition with foreign producers, with greater stability and a richer experience, so frequent a service is neither necessary nor demanded. Should developments of the future again demand more frequent service, the paper will promptly respond.

Each number of the monthly magazine will be much larger than its weekly predecessor, so that there will be little reduction in the total volume of editorial material. At the same time the annual cost to the reader will be less, as explained elsewhere in this issue. As a progressive measure of conservation, therefore, we believe that the new policy will be welcome.

Electrotherapeutics for The Congressional Mind

WHAT there is in the Congressional mind that demands periodic investigations of business is indeed beyond the understanding of most of us. One thing is certain, though: the disease is so much a part of the legislator's make-up that a session of Congress is not complete without a half dozen of these scandal-hunting expeditions starting out to disrupt industry and to undermine the confidence of the business world. That the Senate's recent resolution to investigate an alleged "electric and power trust" is just another manifestation of the old disease is apparent to all who are cognizant of the situation.

The electric industry is ready for any fair investigation and there is the possibility that it is going to give the Congressional snoopers a shock they will never forget. They will probably discover at least one thing that they did not expect—namely, that merely because business is big it is not necessarily dishonest nor working against the public interest. If this one fact can be brought home to the Congressional mind with sufficient emf. to make it impressive, a modern remedy will have been found for an old disease.

Should We Have a Census of Consumption?

ONE of the results of the distribution conference held in Washington last month under the auspices of the Chamber of Commerce of the United States was the appointment of a committee to study the advisability of a census of consumption. The committee's recommendation will be awaited with interest, because all industry is concerned with the subject of its studies.

Consumption statistics are proverbially difficult to obtain and consequently what we now have are spotty and sometimes inaccurate. While it is a comparatively simple matter to enumerate the output of dyes, for example, in the 88 plants that operated during 1923, the task is infinitely more complex when we attempt to catalog the quantities of these same dyes used by the thousands of textile, leather and paper mills as well as the many smaller and lesser known consumers. In the case of certain cruder raw materials, such as cotton and wool, consumption data are obtained with less difficulty and they have come to be regarded as reliable indices of business conditions in the consuming industries.

While it would doubtless be possible to obtain current consumption data for a great many more commodities than are now being studied, it is also true that a biennial or, perhaps, a 5-year census of consumption carried out on the same scale as the present Census of Manufactures would bring together a mass of valuable information for industry. To be sure, it could scarcely be compiled and interpreted in time to be of current usefulness, yet it would be of inestimable value in giving the datum points on which conditions of the present and immediate future might be judged.

It has been estimated that it would cost approximately a million dollars to collect the data for a census of consumption. At first thought this might seem prohibitive, but it is only a small part of the sum that might be saved though more intelligent direction of business based on accurate knowledge rather than on mere guesswork. It is approximately the amount Congress appropriated to the Department of Justice last year merely for its fruitless prosecutions of alleged war frauds. It is less by $350,000 than the sum required to meet the salary increases which the Senators voted for themselves on Feb. 17. However, the question of a consumption census should stand on its own merits. Viewed solely as a business proposition, it is a reproductive service that can pay its own way, and as such it will doubtless find whole-hearted support in industry.

Power Production Again Breaks Record

IN 1924 the production of electricity by public utility power plants was approximately 6 per cent greater than in the preceding year. It was more than 50 per cent greater than in the corresponding period 5 years ago. Thus the power plants of the country continue to grow at amazing rates.

These figures indicate clearly the constantly increasing importance of power supply to industry as a whole. Many of the electrochemical industries long have appreciated this importance and have planned locations and facilities that assure cheap power over long periods. Other industries in which electrical heating or power do not play so important a part have been rather backward in recognizing the importance of this point in selecting plant location.

Industry as a whole may properly conclude that the growth in power supply has been about in proportion to power demand. But in some cases the availability or price of power may be sufficiently different in two plants or two possible locations for plants to become a determining factor in the choice between them. This is but one of the important considerations that must be taken into account by every executive whenever a rearrangement or an important extension of plants is contemplated.

Progress on Naval Stores Standards

SUBSTANTIAL progress in co-operation for observance of naval stores standards was made by a conference of producers with the Bureau of Chemistry during the latter part of January. At this conference it became evident that the immediate problem of importance was that of correct grading of rosin. As a result new steps were taken to insure co-operation, and agreement was reached as to methods to improve conditions where change is needed.

The bureau's policy of "observance, not enforcement" is increasingly clear to producers and users of naval stores. The co-operation of the officials on this basis is assured; and the co-operation of the industry should, of course, be cordially given in return. Through the influence of users of naval stores this policy can be made a complete success, for it will not take long for the bureau to become acquainted with those producers or distributors who are unwilling to do their share if the principal users will bring to the attention of the officials all important cases of misgrading.

Although rosin formed the principal subject of discussion at the last conference, it is evident that mislabeling of turpentine is also a frequent cause of concern to the government or to users of this commodity. The law very clearly defines what is meant by "gum spirits of turpentine," "steam-distilled wood turpentine" and

"destructively distilled wood turpentine." Compliance with these designations for these materials to the letter as well as with the spirit of the law is therefore essential. As soon as this fact is clearly impressed upon the minds of turpentine producers and distributors the bureau will have no difficulty except with those who undertake to mislabel the material for fraudulent purposes.

When the industry is assured of such splendid co-operation on the part of officials and when there is no evidence of unreasonable exercise of the police powers of the government, the industry will be shortsighted indeed if it does not use every possible influence to eliminate careless and illegal methods in the grading of both rosin and turpentine. If suitable co-operation is given to the government, the present comfortable and satisfactory relationship will continue.

Decline in Gold Production And the Chemist's Opportunity

STATISTICS show that the domestic production of gold in 1924 was about half what it was in 1915. A commission of inquiry appointed by the Senate is making an investigation; and it is significant to note that in this, as in almost every other investigation of the subject, the technical side of the question has been ignored. Inflation, immigration, interstate commerce readjustments, "blue-sky" restriction, mineral land laws—these are the subjects under discussion to the exclusion of the major requirement for industrial progress, the encouragement and application of research. What has been done in recent years to solve the problem of treating low-grade gold ores, comparable to the progress made in the treatment of low-grade copper ores? Thanks to technical foresight and a conservatism based on an appreciation of sound fundamental principles, the gold mines of California and of South Dakota still act as the bulwark of domestic production. Work of the highest order has been done in recent years at the Alaska Juneau on ore assaying less than $1 per ton—pioneer effort in the face of undisguised scepticism—that promises a steady augmentation of national yield. But such work, credit for the initiative of which belongs entirely to private engineers, is the exception rather than the rule. The exploitation of low-grade ore has received so little attention, it has been so persistently discouraged, that the present yield is abnormal because of the neglect to develop large deposits in this class, rather than because of the exhaustion of a few high-grade properties.

A review of the literature of wet chemical methods of gold recovery offers convincing proof of the slowness in research leading to reduction in treatment cost. Lump charcoal was first used as a precipitant in 1898; yet only a few weeks ago were we privileged to publish in *Chem. & Met.* details of recent research at Columbia University that points to the use of a cheap, non-fouling and effective precipitant—activated char. Grinding of gold ores has often been carried to a point economically feasible only with rich material, thereby establishing a fashion that excluded from exploitation all ore of lower grade. Possibilities in the application of wet chemical treatment of complex ores have been disregarded because of the indicated cyanide consumption, forgetful of the fact that a cyclic process might well be developed by a chemical engineer that would result in the regeneration of most of the solvent used. Adverse reports have killed numerous prospective undertakings because cyanide consumption in practice has been forecast on the basis of a difference in free cyanide content of the solution used before and after contact with the ore in experimental work. The recovery of gold in waste solution by the addition of acid was proposed by Caldecott in 1899. A quarter of a century later, in 1924, a patent was allowed for an elaboration of the same idea, perfected for mechanical application, whereby both cyanide and contained metal could be recovered from such solutions; there seems no particular reason why the idea could not be elaborated as a scheme of treatment for a complex gold ore or concentrate. This incident, taken in conjunction with the history of the use of char as a precipitant, will give an idea of the absence of determination in the gold mining industry to carry research to a definite conclusion in a reasonable time, largely because the onus of such work has always fallen on the private engineer. Subsidized institutions have shown a lack of initiative. Untrammeled research, not political influence, will increase the output of gold.

What's Wrong With The Textile Industries?

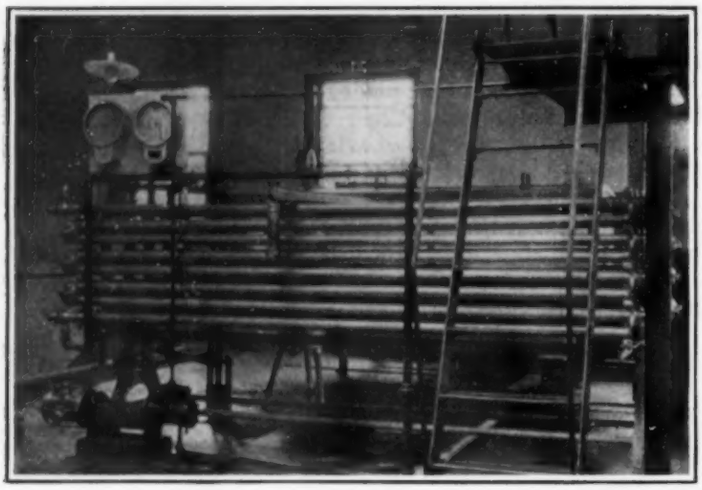
BUSINESS indices and other economic indicators show that the volume of textiles going into consumption is not keeping pace with the growth in the use of other commodities. Indirectly this fact concerns the chemical industries, for the textile manufacturers are among the largest users not only of dyestuffs but of a wide range of other chemical products.

It is the opinion of one of the leading economists of this country that the textile industry is suffering from changes in national habit. The increased use of the automobile has probably influenced our spending habits as far as clothes are concerned. It is apparent, at any rate, that less emphasis is being placed on styles, which on the whole are less radical in their changes. Furthermore, the higher prices for raw materials, when reflected in the cost of finished garments, have no doubt had a restrictive effect on national buying. Still another possibility that came to the mind of the economist was the ultra-conservative attitude of management in the textile industries. Many of the factories are now being guided by a third generation, which is not showing the same progressive leadership that characterized the activities of the industries managed by their fathers.

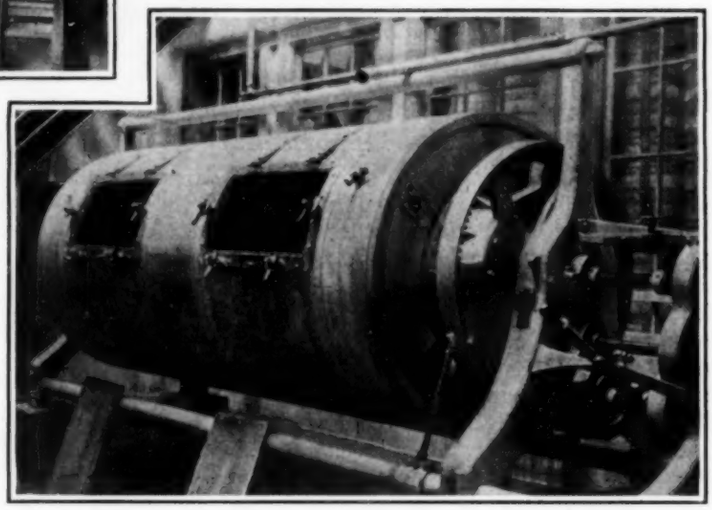
This frank diagnosis by a thoroughly impartial observer is worthy of the serious consideration of the textile industry. Not all of the factors responsible for the industry's condition are within its control, yet it must be appreciated that the future of the industry will largely be determined by the way in which it attacks its present problems.

Subscriptions to "Chem. & Met." Will Be Adjusted

HAVING decided to publish *Chem. & Met.* monthly instead of weekly, as announced on the first page of this issue, the publishers desire to inform subscribers that their present subscriptions to the weekly magazine at the $4 rate will be proportionately extended on the monthly magazine at the new rate of $3 a year.



Cooling coils used in chilling pasteurized milk before bottling. Great care is exercised to keep this apparatus immaculately clean. Much of the piping is disassembled every day for sterilization. Note the recording instruments used to keep operation uniform.



Churn and worker in which the ancient art is applied on an industrial scale in distinctly unit process equipment. It is evident that this apparatus bears a strong resemblance to many forms of equipment used in related industries. Its development, however, was apparently independent.

Chemical Engineering in a Modern Milk Plant

THE technique of processing of milk on a large scale constitutes a chapter in chemical engineering that has not received extensive attention except as applied to evaporating and drying. The modern pasteurizing plant and creamery is, however, dependent upon certain types of apparatus that are common to the entire range of process industries. A curious resemblance may be found between types of equipment found in an up-to-date dairy and in a gelatine plant, a fine chemical plant and a varnish factory.

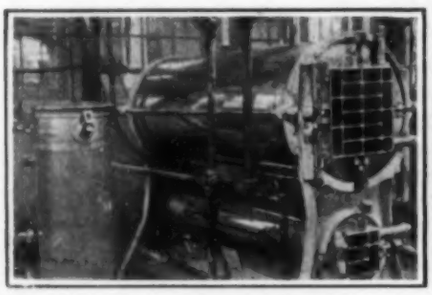
The centrifuge owes its commercial development to a large extent to this industry; many mixers that are widely used are only adaptations of the working-churn; the equipment used for heat exchange, filtering and storage all falls in line with sound chemical engineering design. Strangely enough, most of this development seems to have paralleled rather than imitated that of other industries.

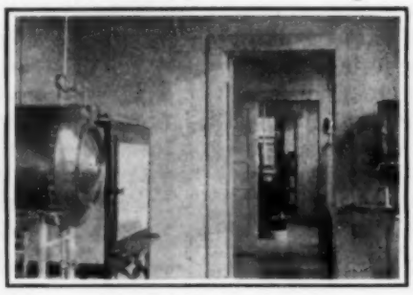
The photographs shown here make clearer the steps through which milk passes on being received at the central plant—in this case that of the Dairymen's League, Newark, N. J. The milk, coming in by truck in cans, is stored in glass-lined tanks at 40 deg. till it is pasteurized. It is then pumped through german-silver plated pipes to a storage tank that feeds the upright filter shown at right of lower left-hand photograph. Johnson & Johnson sterilized gauze bags are replaced in these filters about once an hour, serving during that time as the filter medium removing all insoluble foreign matter. The milk is next drawn through the square bronze coils of the interchanger "pasteurizer" shown at right of filter, where the temperature is raised to exactly 142 deg. F. The milk is stored at this temperature in copper containers for 30 minutes, and is then rapidly chilled to 40 deg. F. in the tubular interchanger shown at top of page in the annular section of which brine is circulated.

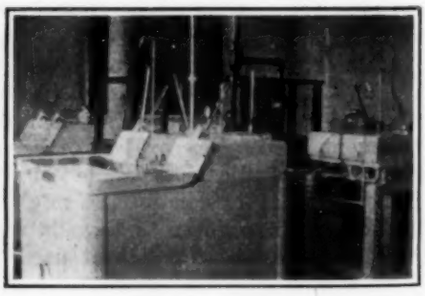
The manufacture of butter proceeds along similar lines. The milk is pasteurized, then cooled and run through a centrifuge in which nearly 100 per cent of the butter fat is split out. This is ripened in deep enamel-lined tubs equipped with coils and regulators for temperature control. Bacteria are planted in order to hasten this ripening, and temperatures are maintained that induce the best possible condition for butter making.

The homely churn, shown below the cooler, is of cypress with three corrugated wooden rolls running through just off the central axis. When the butter has separated from the milk, these rolls are set in motion, salt and color are added and the product is worked into marketable form.

The laboratory, of which two views are shown below, functions for both control and research activities.







Getting the Most From Lemons

The Sicilian Citrus Byproducts Industry Is a Curious Mixture of Modern Technology and Ancient Tradition

By W. V. Cruess
Fruit Products Laboratory, University of California

ALTHOUGH California has become an important competitor, Sicily still produces the major portion of the world's supply of citrus byproducts. Most citrus fruits are grown in Sicily primarily for export in the fresh state. In normal times only the culls from the fresh fruit packing houses and the windfalls are utilized for byproducts. However, when the market for fresh fruit is unfavorable, as for example, during the war, much first-class fruit finds its way to the byproduct factories. The normal annual production of lemons in Sicily is about 7,500,000 boxes, or 300,000 tons. The American Consul at Messina estimates the production of citrate for 1923 at 7,500 to 8,000 tons. The exports of essential oils are about 1,650,000 lb. per annum. Messina is the most important byproducts center, with Palermo second. Lemons are grown on a narrow strip extending from Messina to Syracuse on the south and from Messina to Palermo on the north coast. On the mainland, across the straits from Messina, lies the Calabrian district, famous for its oil of bergamot.

In 1908 the Camera Agrumaria was established by the Italian Government to protect the small producers of citrate by the maintenance of a profitable and fixed price. During the war and 3 years following, the Camera purchased all citrate produced in the island, and promised to pay the producers on the basis of 25 per cent on delivery and 75 per cent as a warehouse loan. As a result, everyone who could do so made citrate, and the Camera was overwhelmed. In 1921 it was decided to accept citrate only at the seller's risk. A tremendous surplus has accumulated, and the Camera on May 31, 1923, according to a consular report, owed $3,870,000 for citrate accepted under the old plan, and it had on hand more than 20,000 tons, or enough to meet world demand for 3 years. The production of citrate is now discouraged, and the export of green fruit is favored. Needless to say, the producers of citrate are hard hit. Economic conditions in general are bad, and most of the population is tragically poor. Luckily, essential oil was not placed under the control of the Camera, and its production has more nearly kept pace with demand.

Hand Methods Still Prevail in Essential Oil Manufacture

Essential oils produced include lemon oil, bergamot oil, oil of bitter orange, oil of sweet orange and oil of neroli (orange-flower oil). Most of the lemon oil marketed is still produced by the hand-extraction method. This may appear to be crude and costly, but it yields an oil that is superior to that made by any other process, and at low cost. The lemons are brought from the fresh fruit packing houses to the factories, usually in the cities or towns. They are cut in half, usually crosswise, although if the peels are to be exported in brine after extracting the oil, they are cut lengthwise. The cutting is done by women and girls who work with remarkable skill and rapidity. Other women and girls scoop with a spoonlike knife the pulp from the halved fruits. The peels are placed in wicker baskets and the pulp is sent to the juice extraction room, where it is crushed and pressed for the manufacture of calcium citrate.

In order to render the oil cells turgid and thus facilitate the expression of the oil, the baskets of peels are immersed for a short time in cold water and allowed to stand several hours. The men who extract the oil from the prepared peel sit on low stools before bowls about 1 ft. in diameter. Across the top of the bowl is a stick, notched near the ends so that it fits tightly into the bowl. On the stick rests a large sponge, and

International Institute of Agriculture at Rome

The Italian Government maintains two experiment stations for the citrus industry, one near Messina, and one at Reggio. Byproduct utilization and cultural practice are studied.

on this sponge rests a smaller, cup-shaped sponge. The operator places the peel inside the small sponge. With the palm of the hand the peel is folded and pressed with much of the weight of the body. The peel is again folded in another direction and pressed two or three times, the whole operation requiring much less time than is needed to describe it. The sponges absorb the expressed oil, which is wrung from them into the bowl. Considerable juice accompanies the oil and is separated from it by decantation. Beneath the lip of the bowl is a depression into which the juice settles as the bowl is tilted, allowing the oil to be poured off. The residue is filtered through cloth, and the filtrate separated by decantation. The oil is allowed to settle for a day or more, and is then filtered through paper, giving a brilliant light amber product. This is stored in large sealed copper flasks, out of contact with light and air.

Machine Extraction of Essential Oil

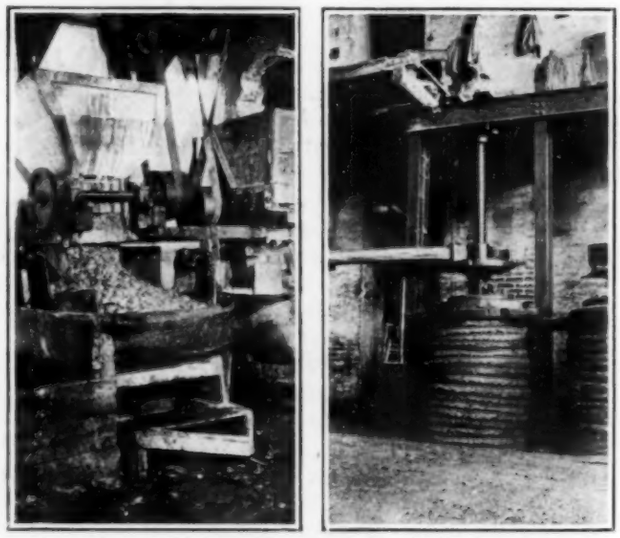
According to the estimate of Ogsten & Moore, analytical and chemical engineers of Messina and London, about 10 per cent of the essential oil of Sicily is now extracted mechanically. The equipment is far from perfect, but its practicability has been demonstrated. The simplest machine is the Zona, consisting of a hand-operated lever and plunger, which presses the prepared peel in a cup-shaped sponge, as in the hand-extraction method. It makes possible the substitution of cheap female labor for the more costly skilled adult male labor required for the sponge method. It gives an oil of good quality.

The Verdi machine, a Palermo invention, is of much greater capacity than the Zona. It consists of a wheel equipped with fine teeth and revolving inside a circular casing, also toothed, and held under tension by springs. The lemons are carried through the casing by the toothed wheel, rolling as they travel. The teeth produce hundreds of small punctures in the peel through which the oil is liberated. Sprays of water wash the oil from the fruit and machine to settling tanks, from which it is skimmed by sponges. The lemons must be graded for size before treatment in the machine; usually a battery of five machines is used, for five different sizes of fruit. The settling of the liquid from the machine to recover the oil has two objections; much of the citral of the oil dissolves in the water, and fermentation often sets in, imparting to the oil a disagreeable odor. A milk separator may be used to separate the oil and water as it comes from the machine.

Messina has produced the Vinci machine, similar to the Verdi in principle, but in it the wheel revolves in a tank of water and the casing, in section, is held under tension by weights and pulleys. This machine takes ungraded lemons, but breaks about 20 per cent of them, which is objectionable. A slow stream of water flows through the tank to float the oil. The overflow goes direct to an Alfa Laval centrifugal separator, which effectively skims off the oil.

In a process invented by Bennett, of Ogsten & Moore, the lemons are crushed between heavy rolls, which press the juice from the pulp and the oil from the peels. The juice and oil are separated from the peels by a vibrating screen, the oil being recovered from the mixture by a centrifugal separator. Thus far the yield has been low, but the quality of the oil is good. At present Bennett is experimenting with the Verdi machine, which he expects to improve.

The Calabrian machine for bergamot oranges has been in successful use for many years. The oranges are grated between revolving, horizontal disks, operated by a simple mechanism turned by hand. The output per man is not much greater than by the sponge method, although the quality of the oil is about as good as that from hand pressing. According to C. Rodano, an engineer of Messina, neither the Vinci nor the Verdi, the two most successful machines, is satisfactory. Skilled mechanics are necessary for operation, and the quality of the oil is inferior to that from hand pressing, being darker in color and lower in citral content. Some citral is lost in the water and juice. However, the machine-made oil is well above the U.S.P. minimum in citral content. The machine-made oil is blended with that obtained by hand pressing. The residues from hand pressing are diluted with water and distilled at atmospheric pressure. A low-grade oil is obtained. According to Rodano, oil is recovered from low-grade windfall



Treating Pulp From Lemons
The roll mill on the left crushes the pulp, after which the juice is pressed by the screw press shown on the right.

lemons at Palermo by distillation in vacuo, by a method and apparatus devised by Professor Peratoner, of Palermo University. This is apparently the most economical method of treating lemons the skins of which have become dry and tough. Oil obtained by vacuum distillation is much superior to that obtained by distillation at atmospheric pressure, but greatly inferior to hand-pressed oil or even to that expressed by machine. Such oil should not be blended with cold-pressed oil, because it deteriorates more rapidly.

The natural oil contains a large proportion of terpenes, which do not possess great flavoring power and are objectionable because of their instability and tendency to become "turpentiny" by oxidation during storage. They are to a large extent removed in making the so-called terpeneless oils. The process usually consists of first distilling the oil in vacuo to remove the terpenes. The product is then steam distilled at ordinary pressure to separate resinous matter, which is usually utilized by mixing it with the terpenes from vacuum distillation. Some of the terpeneless oil is converted into "sesqui-terpeneless oil" by dissolving in strong ethyl alcohol and diluting with water to precipitate the sesqui-terpenes, which are removed by filtration. The sesqui-terpeneless oil can then be separated from the solvent by distillation.

The oil is placed in large copper flasks. These have small inlets, and are tightly covered and are stored in a cool room, thereby retarding oxidation. Nevertheless, under average good commercial storage conditions, the citral is said to decrease at the rate of about 0.1 per cent per month. If kept in completely filled sealed bottles stored in the dark, the change is scarcely noticeable. In partly filled containers, not tightly sealed, the loss in citral and the formation of resins is serious and the oil soon becomes worthless. Tin containers are satisfactory for storage if the tinning is perfect and if the tanks are well filled and sealed; but if the iron is exposed and the oil is not free from juice, corrosion occurs and the oil becomes discolored.

Acid Technology Well Developed

The pulp remaining after expressing the essential oil, either by the hand or by the machine process, is utilized for the recovery of calcium citrate, which in turn is converted into citric acid. The manufacture in Sicily of the finished product, citric acid, is of recent origin. Formerly the intermediate, calcium citrate, was exported to be made into citric acid elsewhere, notably in America and Great Britain. There is now one large modern plant at Palermo, that of the Fabricca Chimica Arenello; a smaller plant at Messina known as the Isac Citric Acid factory; a new factory at Tremestieri owned by Sanderson & Co., and a fourth at Santa Teresa di Riva, owned by the Societa Generale per l'Industria Chimica.

Several small citrate factories were visited. That of Corleone & Co. of Palermo was larger and better than the average and will serve to illustrate the process. The pulp scooped from the halved lemons, in preparation for hand pressing of the peels, is first crushed. The crushed fruit is packed into esparto grass press bags, which are stacked on the floor of a hand screw press. The juice obtained by pressing is transferred by pump to a wooden vat holding about 1,200 gal., where it is heated by iron steam pipes and steam jets to the boiling point. Calcium carbonate is added, with constant agitation, to the neutral point as shown by test paper. Stirring is done with slowly revolving wooden paddles attached to an upright shaft in the center of the vat. The precipitate is allowed to settle, and the hot liquor is drained through rough bag filters, which recover the suspended citrate. The citrate in the vat is drained as free of liquor as possible and is then shoveled into screen trays. Citrate is much less soluble in hot than in cold solutions, hence the need to maintain a high temperature. The trays are placed on shelves in a small stone room with a vent in the ceiling. In the center of the room is a large metal basket in which charcoal or coal is burned. The heat dries the citrate, but the method is inefficient and slow. The dry citrate is broken up, packed into hogshead barrels and sold on citric acid content, as shown by the analysis of qualified chemists. The basic content of citric acid on which citrate is bought and sold is 64 per cent. The citrate manufacturer guarantees this as a minimum.

A weighed amount of the citrate is dumped into a vat and mixed with water to give a thin paste or milky suspension. A measured amount of sulphuric acid (said to be 60 per cent H_2SO_4) is added and stirred until the reaction is complete. The decomposing process is controlled by careful analyses of the raw materials and of the products of reaction. The precipitated calcium sulphate is removed in a filter press equipped with wooden plates and frames. The dilute citric acid solution is concentrated in six large single-effect lead-lined vacuum pans to a fairly heavy sirup. Crystallization is allowed to take place in lead-lined shallow tanks, in which a slowly revolving agitator is used to induce the formation of small crystals, which are easily centrifuged in an ordinary basket sugar centrifugal to remove adhering mother liquor. The mother liquor is mixed with fresh dilute citric acid liquor from the filters. The crude crystals are dissolved in water, and the solution treated to remove metallic impurities, principally iron. A vegetable decolorizing carbon is added to remove excess color, and the mixture is heated and filter pressed. The second concentration is made in vacuo, and final crystallization takes place on the sides and bottom of lead-lined tanks and on strips of lead suspended therein. The crystals are drained, dried in the air and classified by screens into three sizes. Much of the largest size is ground or powdered. It is packed in small chestnut barrels for export.

Research Staff Maintained

In addition to the control laboratory, a research staff is maintained to develop manufacturing processes and to utilize byproducts. This factory already engages in several lines of manufacture and contemplates further expansion. The juice from lemons to be used in making citrate is first allowed to ferment. This is distilled to recover ethyl alcohol, and the hot residual liquid is neutralized with milk of lime to give calcium citrate. Thus the heat used in bringing the juice to the distillation temperature is not lost. This makes the recovery of the relatively small amount of alcohol a paying proposition, even at the low market price of 10c. per liter.

The wineries of Sicily, the neighboring islands and nearby mainland sell their wine lees and crude argols to the Fabricca Arenella, in which it is converted into tartaric acid by a process resembling that used for citric acid. The crude raw material is boiled with water to extract the cream of tartar. The hot mixture is filter pressed. Milk of lime is used to neutralize the acid tartrate, with the formation of insoluble calcium tartrate, which is separated by filtration in the cold. The tartrate is mixed with water, decomposed with sulphuric acid, filter pressed to remove calcium sulphate decolorized with vegetable char, filter pressed, concentrated in lead-lined vacuum pans, cooled, and allowed to crystallize, as described for citric acid.

Lemon peels are shipped in brine to America and elsewhere. The method of preparation observed at Palermo consisted in storing the peel a few days with a coarse rock salt, packing into hogsheads and filling these with sea water. Some lemon juice is concentrated to 64 per cent citric acid by boiling in open copper kettles, but the demand is limited. At one time it was hoped that this concentrate could evade the American tariff. Some juice is also concentrated by freezing and separation of the ice. The experimental station at Reggio has obtained good results, and it is believed that the method has commercial possibilities.

Fresh juice preserved with chemical preservatives is shipped in small quantities. Some orange peel is dried, and some of the bergamot peels are shaped into small circular boxes to be decorated and used for vanity boxes. These are very aromatic and of attractive appearance. Commercial experiments on the preparation of pectin from waste lemon peel have been made, but thus far no pectin industry has been established.

A Professional School of Engineering

An Analysis of the Curriculum and Underlying Philosophy of the 6-Year Course in Chemical Engineering at Columbia

By Charles Wadsworth, 3d
Managing Editor, *Chem. & Met.*

IN 1911 there appeared at Columbia a professor of chemical engineering, named M. C. Whitaker. He is so widely known as an industrial leader that he needs no introduction to a *Chem. & Met.* audience. Whitaker conceived the chemical engineering course at Columbia and under the impulse of his virile personality it took shape. The present course is a logical development of his ideas, with the modifications that have been made possible by the addition of capable men to the staff.

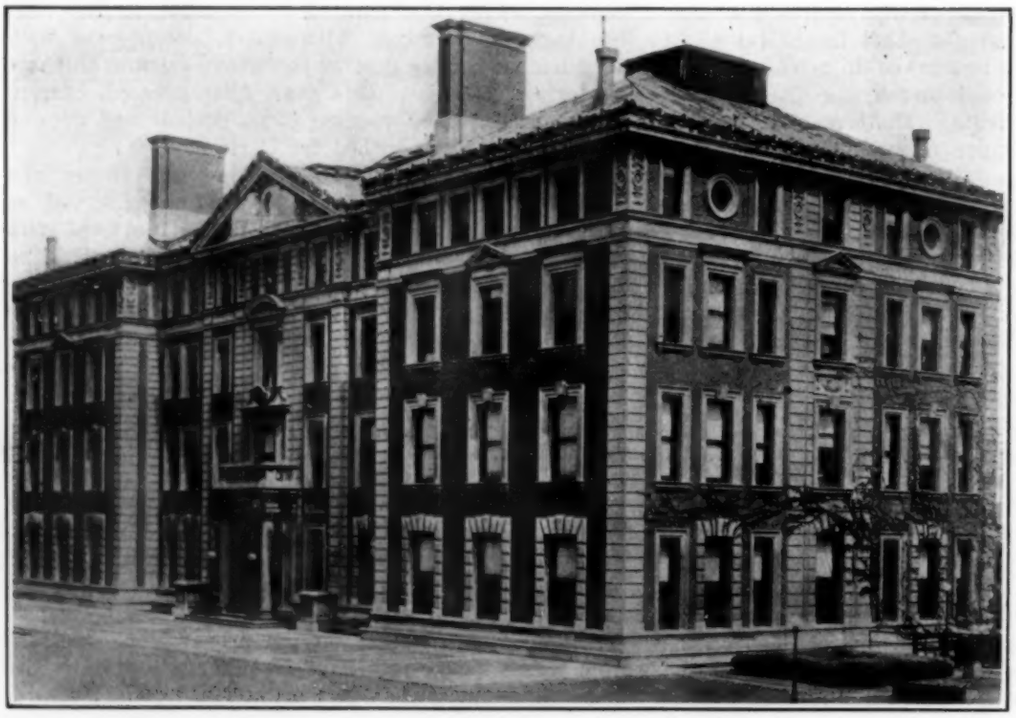
The curriculum is laid out on the basis of a 6-year course, and it is this that we shall discuss. Various modifications have been made so that students, well prepared at school, can complete the work in 5 years and so that graduates of other schools and colleges can matriculate for 2 or 3 years and obtain the degree of Chemical Engineer.

It should be understood at the beginning that chemical engineering at Columbia is essentially a graduate course. The first 3 years, the so-called pre-engineering course, resemble more nearly a course in liberal arts, and that is precisely what is intended. The authorities believe that there is much to be said for that famous definition of a university—to wit, Mark Hopkins seated on one end of a log with the student on the other end. Therefore 28 per cent of the first 4 years is given over to electives and cultural courses, and each engineering student has an opportunity to come under the influence of Mathews and Hazen and Kemp and Dewey and other great Columbia teachers and leaders of thought. It is almost impossible to make a direct comparison of the Columbia curriculum with that of other schools, because of this emphasis of cultural subjects. Nor can we eliminate this group and note the percentages of the remaining subjects, inasmuch as there are nearly 8 hours of optional subjects in the last 2 years that may be elected in one or another group.

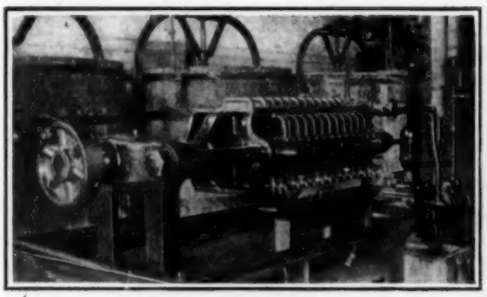
For convenience we shall consider the first 4 years as a unit, for the student may stop at that point and receive a college degree. Then we shall take up the fourth, fifth and sixth years as a group representing the professional training of the chemical engineer, and at Columbia he is visualized as a man of vision capable of directing affairs in the chemical engineering industries.

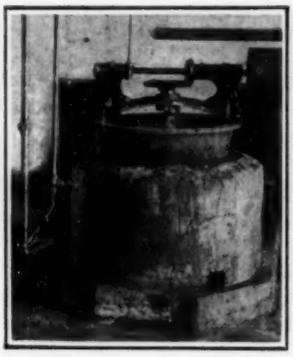
There are at least four points of major interest in the 4-year course. The first is the easy stages by which the student is inducted into his professional work. Chemistry makes its appearance in the second year, and at the end of the fourth year only 15 hours have been taken up with it. That means inorganic, qualitative, quantitative and organic. No physical chemistry has yet appeared. In the engineering subjects there is nothing but mechanical drawing till the fourth year, and then only mechanics and power generation. Chemical engineering makes its initial appearance near the end of the fourth year. That is all an essential part of the idea of liberal arts as a background for professional training.

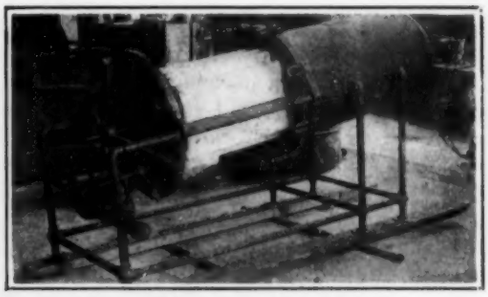
The second unusual point about the first 4 years is physics. Nearly 13 per cent of the total number of hours is devoted to this subject, or about twice as much



Havemeyer Hall—The Home of Chemical Engineering at Columbia







Some Semi-Plant Equipment in the Chemical Engineering Laboratory

as the average of other schools. It is a tradition of long standing at Columbia to emphasize physics, and the dean's professional predilection for that subject has not tended to diminish that emphasis. There are few ways that time could be better spent, but the law of diminishing returns begins to operate at about 7 or 8 or 9 per cent and in the opinion of the commentator 13 per cent is too much of a good thing.

Point No. 3 is found under miscellaneous subjects in the first year. It is called contemporary civilization. This is one of the finest ideas in modern education. It is being worked out at several universities and it is almost certain to be universally adopted within the next decade. It is a course that orients the student with his environment. In the lectures and conferences and outside reading he is made familiar with the great principles of physical science, with the study of cosmic phenomena, with the beginnings of human society and the consequent development of the social sciences, economics, ethics, religion and art. The aim of the course is to supply perspective and to eliminate the idea that chemistry and physics and psychology exist in watertight compartments without any points of contact. It is hardly chemical engineering, but its value to the engineering student is incalculable.

The fourth major item of interest in the pre-engineering course is the 9 hours of elective subjects, which amount to 17.5 per cent of the time in the pre-engineering work and 12.5 per cent of the first 4 years. This has already been referred to and it needs but little further emphasis. There are two main ideas behind this plan. The student not only takes up his professional studies with more maturity and background but because he takes them up gradually he digests the subject matter more thoroughly. And when he finally gets into the last 3 years of the course he is ready for an intensive campaign.

Several minor points are of interest also. Mathematics appears to be somewhat underdone. But when this was pointed out, it was discovered that mathematics was ridden hard through physics and mechanics and particularly through Professor Lucke's brilliant courses in engineering.

Languages is another subject that appears to be relatively neglected, totaling less than 5 per cent of the curriculum. The staff realizes the importance of language requirements and one of them remarked: "Naturally, our 6-year men read both French and German. In fact, they are almost invariably better equipped than our Ph.D. men on languages." We can

	1st Year	2nd Year	3rd Year	4th Year	Total	
					HOURS	PER CENT
English	Composition & Literature 3				3	4.2
Mod. Lang.	German & French 3				3	4.2
Economics		Principles of Econ. 3			3	4.2
Physics			Mechanics, Sound, Light & Electricity 6½	Heat & Radiation 2 Laboratory ½	9	12.8
Mathematics	Alg. & Anal. Geom. 3	Calculus 3			6	8.5
Chemistry		Gen. Inorg. 5	Qualitative Anal. 2	Organic Chem. 5 Quantitative Anal. 3	15	21.4
Engineering		Mech. Drawing 2 Descrip. Geometry 1		Mechanics 3 Power 2	8	11.3
Chem. Eng.				Industrial Chem. ½ Elements Chem. Eng. 1 Laboratory 1	3½	5.0
Miscellaneous	Contemporary Civil. 5 Phys. Education 3	Phys. Education 3 Electives 1½	Electives 7½		20	28.4
Total	17	18½	16	19	70½	100.0

Fig. 1.—Analysis of the First 4 Years of the Columbia Course in Chemical Engineering

Summer Work:—
Factory Inspection ------ 2 Weeks
Factory Practice ------- 6 Weeks

only judge by results in that case, but French and German are certainly "musts."

Turn now to Fig. 2, which shows a flow sheet of the professional work of the course. It tells the story more clearly than a chart like Fig. 1; for it indicates the options that are possible and logical sequence of courses following certain options. The courses fall into four groups: Chemistry, Chemical Engineering, Engineering and Miscellaneous. In each of these groups there are several sequences, as for example under chemistry there are physical chemistry, organic chemistry and quantitative analysis. Under chemical engineering there is on the one hand industrial chemistry and on the other chemical engineering and so on. All courses in boxes with full-line borders are required, whereas the optional courses are inclosed in dotted boxes. In addition the alternatives all appear on the same horizontal line. For example, a course on the phase rule in the sixth year may be elected in place of courses on synthetic organic drugs, steam power or factory management.

Certain things about this program of professional work should be emphasized or discussed. It can be safely said that the work of the student is directed toward two courses. They are the chemical engineering thesis and the course in chemical plant design. In other words, the student is supposed to use all of his previous training in this work. The chemical engineering thesis consists of original work of some kind usually carried out on chemical engineering equipment. It is primarily designed to teach the student research method—the "how" of approaching industrial problems. The other course, in plant design, is usually carried on in groups of three and the problems are gaged to work up to a final engineering report on a plant of some kind. The students are required to investigate the process, to select the best method, to get quotations or approximate costs on equipment, to make detailed drawings of layout and to conclude with a recommendation as to the advisability of the project. Both of the courses are significant and valuable. It might perhaps be wise to devote more time to them at the expense of less important subjects. But at least they make a logical focal point for the curriculum.

The studies leading up to these focal points must be discussed specifically, but they seem to warrant several general comments. Here, as in the pre-engineering work, an effort is made to permit the students to come in contact with great teachers, whether the subjects are particularly germane to chemical engineering or not. Such procedure deserves hearty indorsement in the pre-engineering work and the indorsement should also apply to the professional work provided nothing essential is neglected. Obviously this is a matter of judgment, but there are some optional subjects in the Columbia course which should probably be required of chemical engineers.

To return to individual subjects on Fig. 2, the chemistry required is about average in amount. There is nothing unusual in the requirements. The options in physical chemistry are unusually strong, whereas the organic options seem specialized. Such courses are splendid as prerequisites for organic research, but as alternatives for pyrometry and flow of fluids (hydraulics) or for phase rule and theory of solution they do not seem to have sufficient value to the chemical engineer.

Chemical engineering is approached from the standpoint both of industrial chemistry and of unit processes. Both approaches are valuable. The path through industrial chemistry is broad and easy if the instructor has had no plant experience and devotes himself to a description of industrial processes. How completely sterile such a course can be! If the instructor has had industrial experience and can talk not in terms of processes and outlines but in terms of problems, then the course becomes almost perfect as a method of instruction. At Columbia such courses as industrial electrochemistry given by Prof. Colin Fink are excellent examples of this type of course. So too there are courses in industrial inorganic, industrial organic and the industrial application of colloids, all given by men having close contact with industrial practice.

The unit process path begins with a study of mate-

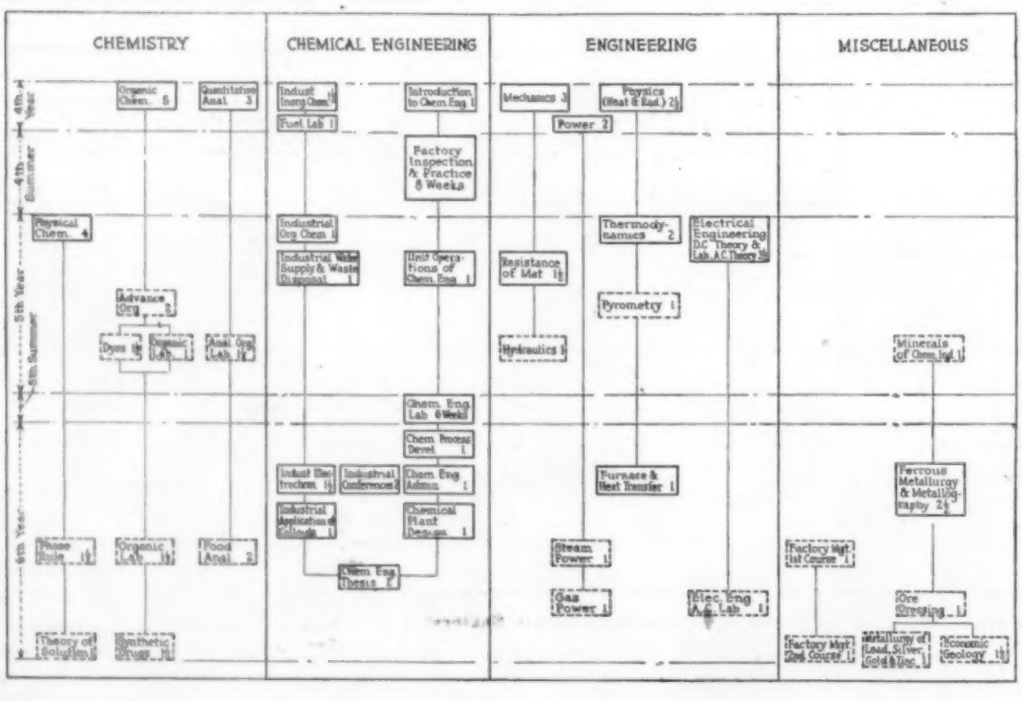
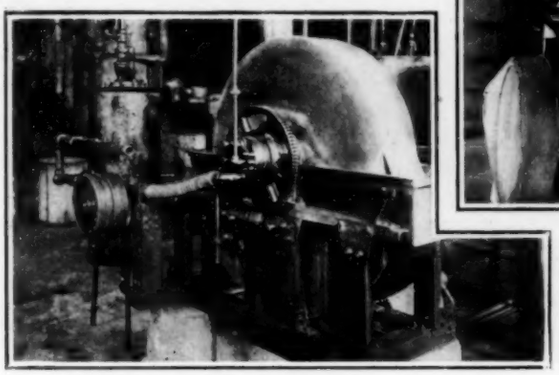
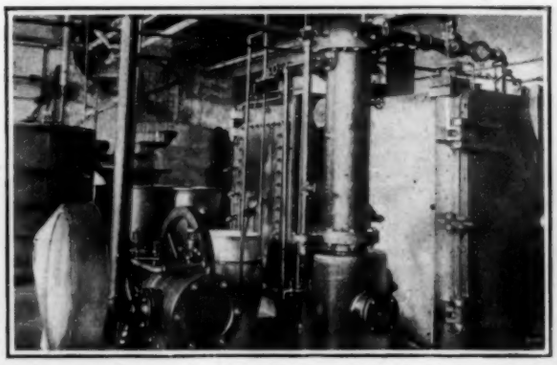


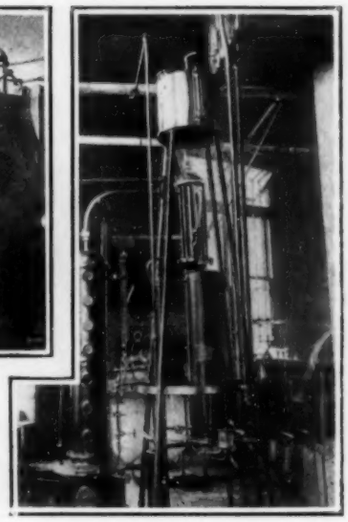
Fig. 2

A charted analysis of the fourth, fifth and sixth years' work in which the professional work is largely concentrated. The required courses have a full line box around them, whereas the optional courses are in dotted boxes. The dotted boxes on a given horizontal line are alternatives. Note also the sequence of courses in each column.



A Rotary Filter, Vacuum Drier and Fractionating Column in the Chemical Engineering Laboratory





Unit Process Equipment Is Studied from the Point of View of Both Design and Operation

rials of construction, with especial reference to corrosion resistance. The following summer a plant inspection trip of 2 weeks is taken with a member of the department and then the embryo chemical engineer must take a job in a plant. It matters little what kind of a job. A pick and shovel is as desirable as any other set of tools. The idea is to get experience in practical production work, to develop the plant point of view. Following this the principles of chemical engineering are studied and driven home during the next summer by means of intensive work with unit process equipment in the chemical engineering laboratory. This laboratory has gradually installed a representative lot of equipment over many years, so that the student has an opportunity of familiarizing himself with the operation of many types of machines. The laboratory is an expensive piece of educational equipment as regards both investment and maintenance, but the department feels that there are compensating advantages of flexibility for investigational work and immediate availability of equipment. During the last year there is the thesis which has already been mentioned and the course in chemical plant design—the other focal point of the course. As a kind of semi-final round there is an interesting bit of work on chemical process development in which the student actually translates a laboratory process into a plant-scale report by means of the chemical engineering laboratory equipment. It is an intelligent educational effort and ought to prove invaluable to the student. Finally, there is a series of lectures on chemical engineering administration that helps to paint the background of industry for the student.

Only a word or two need be said of the engineering and miscellaneous groups of studies in Fig. 2. The former includes 17 hours of essential and required courses. Electrical engineering is perhaps a little overemphasized, but the administrative difficulties involved in a separate course are responsible. Some of the other courses, such as power, furnaces and heat transfer, thermodynamics, have a different arrangement in other institutions, but with Professor Lucke available the only important question to be asked is, "What courses is he giving?" There are 5½ hours of engineering options. Hydraulics is not essential, as flow of fluids is taken up in the chemical engineering courses. Pyrometry and A. C. laboratory are usually taken and the courses in steam and gas power are less essential. In the miscellaneous group our old cousin, metallurgy, is required and inasmuch as it is given by Campbell there can be no protest. It's the old definition again—Mark Hopkins and the log. The rest are borderline courses and it is questionable whether they deserve a place among the options.

The course at Columbia needs no eulogy. No course that is given by men such as those we have mentioned can be anything but a strong course. It suffers from an overdose of physics, industrial chemistry and electrical engineering. It suffers from too great flexibility in the matter of options, which tends to encroach on the time available for key courses. But there is no course in the country that deserves more careful study than this one. It stands for the thesis that the teacher should be the unit of education rather than the course, and it is the foremost champion of chemical engineering as a professional course taken by mature students with some previous collegiate training.

First 4 years	5th Year	6th Year	Options*	Total Hours	Total Per Cent
English..... 3				3	2.9
Mod. Lang.. 3				3	2.9
Economics... 3				3	2.9
Physics..... 9				9	8.7
Mathematics. 6				6	5.8
Chemistry... 15	Physical Chem. 3½		2	20½	19.7
Engineering.. 8	Thermodynam. 2 Resis. of Materials 1½ Elec. Eng. 3½	Furnaces & Heat Trans. 1	4	20	19.2
Chem. Eng... 3½	Indus. Organic. 1 Water Supply & Waste Disposal 1 Basic Operations of Chem. Eng. 1	Indus. Electrochem. 1½ Chem. Process Development 1 Chem. Eng. Administration 1 Chem. Eng. Thesis 2 Indus. Conferences 2 Applied Colloids 1 Chem. Plant Design 1		16	15.4
Miscel..... 20		Metallurgy and Metallography 2½	1	23½	22.5
Options.....	3	4	7		
70½	16½	17		104	100.0

Summary of the 6 Years' Course

Note that the options in the vertical column are distributed among various subjects in what may be considered an average ratio. The percentages therefrom are qualitatively correct. It does not, however, include the summer work in chemical engineering.

Fig. 1—The Rjukan Nitrate Factories

Rjuken I in foreground, Rjuken II in background

Fig. 2—Vermork Power Station at Rjukan, Norway

This was the first station erected in this district and has a generative capacity of 100,000 kw.

Fig. 3—Saaheim Power Station

Each turbine generator has a capacity of about 17,500 hp.

Fig. 4—Birkeland-Eyde Furnaces at Rjukan II

The waste-heat boilers are to be seen above the furnaces and to the right.

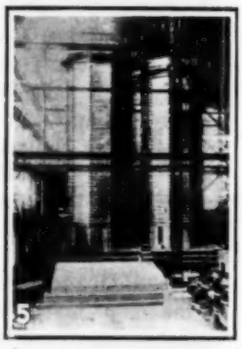
Fig. 5—Granite Towers at Rjukan Plant

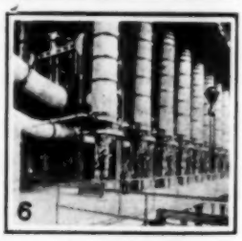
These towers are for the absorption of nitrogen oxides. They are 70 ft. high and 22 ft. in diameter.

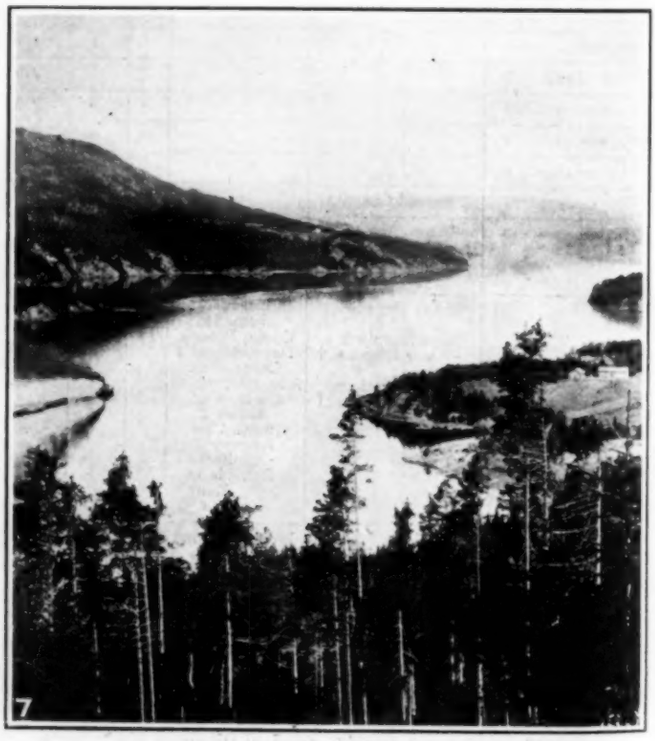
Fig. 6—Schönherr Electric Arc Furnaces at Rjukan I

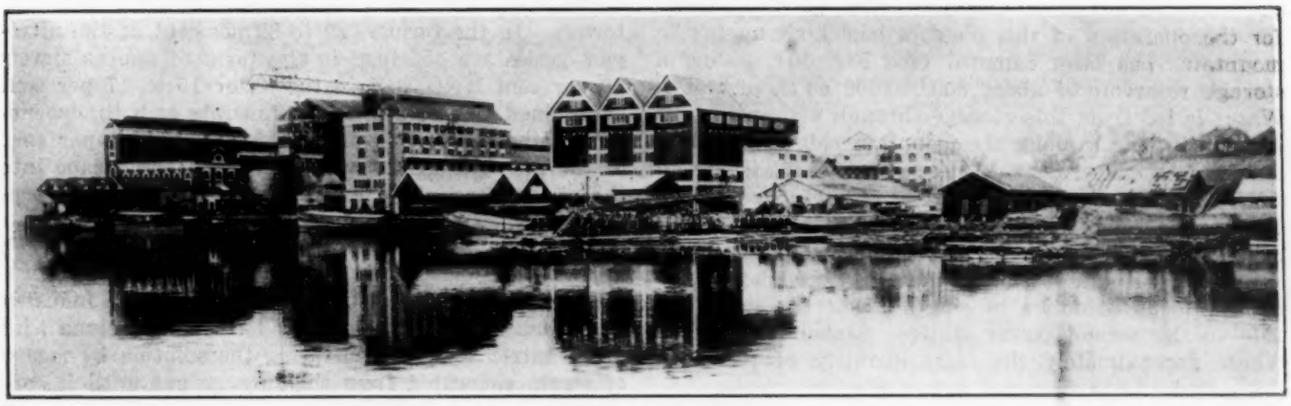
Fig. 7—Hitterdalsvam, a Lake Near Notodden

The transportation of Norwegian saltpeter to the sea is effected in lighters such as are to be seen in this picture.









The Nitrogen Fixation Plant at Notodden, Norway

Nitrates From the Air

Some Unique Features of Norway's 20-Year-Old Industry

By J. M. Braham

Chief, Chemical Division, Fixed Nitrogen Research Laboratory
U. S. Department of Agriculture

NORWAY was the first country to produce nitrogen compounds from the air on a successful, commercial scale. Having very cheap water power, it was possible to use advantageously the electric arc process of fixation and at the present time Norway produces fully 95 per cent of the nitrogen fixed by that process. For this purpose the Norwegian plants employ 350,000 hp. Although ranking next to Germany in quantity of fixed atmospheric nitrogen produced, Norway's output is only about one-tenth that of Germany. A few points of interest in connection with this unique industry, which occupies such an important place in Norway's industrial life, are briefly sketched in this article.

The Norwegian nitrate industry had its beginning in 1903, when Prof. K. Birkeland and Eng. S. Eyde successfully applied the principle of the spreading of an electric arc by means of a magnetic field to the problem of securing greater energy efficiency in the fixation of nitrogen in the electric arc. Starting with a 3-kw. furnace, they extended their experiments successively on several units up to 300 kw., and in 1905 the first commercial units, 500 kw. each, were put into operation at Notodden. The plant proved highly successful and formed the basis of the present large nitrate industry in Norway.

This industry is controlled by the Norwegian Hydro Electric Nitrogen Co. (Norsk Hydro-Elektrisk Kvaelstofaktieselskab), frequently referred to as the Norsk-Hydro Company, with main offices in Oslo (Christiania). Some Swedish and French capital is invested in this Norwegian industry and from 1907 to 1911 the Badische Anilin und Soda Fabrik of Germany was also financially interested in it. The company's nitrogen properties consist of two fixation plants, a small one located at Notodden, which is about 100 miles southwest of Oslo, and a very large one at Rjukan, about 50 miles northwest of Notodden; hydro-electric power stations; electric railroad and ferries between the two plants; and docks with warehouses at Menstad on Skiensfjord in southern Norway, the main shipping point by water. A research laboratory is maintained near Oslo.

Following the successful operation of the small commercial plant at Notodden in 1905, the development near by of hydro-electric power at two sites, Svaelgfos and Lienfos, was undertaken, which furnish about 50,000 kw. In 1908, the nitrate plant was enlarged to approximately its present capacity of 7,000 tons of nitrogen per year. A general view of this plant is shown in the headpiece to this article. The main power and nitrate developments are, however, at Rjukan, which is located in a deep, narrow valley, Vestfjord-dalen, in an isolated mountainous district far inland, and which is reached from Notodden only by the company's own electric railroad and car ferries. The Rjukan plant is in reality two practically separate and equal size plants, commonly referred to as Rjukan I and Rjukan II. This plant and a part of the industrial village of 10,000 inhabitants, which has been built by the nitrate industry, is shown in Fig. 1. The construction of Rjukan I was begun in 1908 and completed in 1912; Rjukan II was completed in 1916. The entire plant has a capacity of 28,000 tons of nitrogen per year, or about four times that at Notodden, and requires for its operation approximately 210,000 kw., or 280,000 hp. To provide a steady source of power

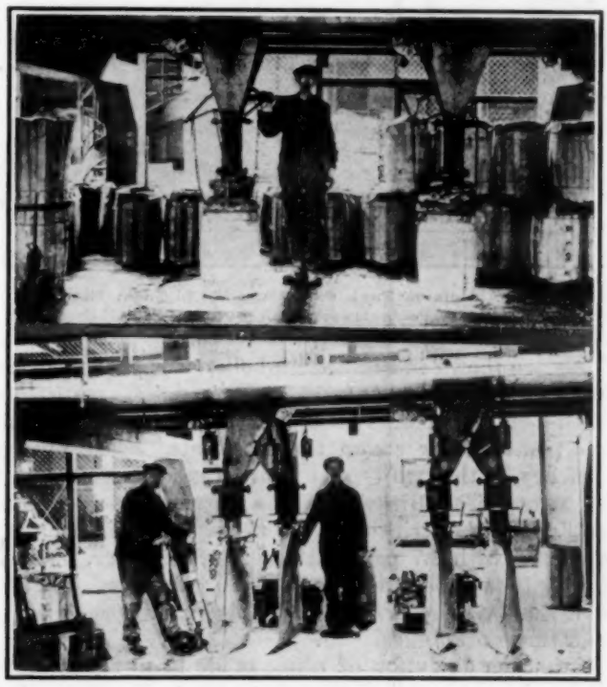


Fig. 8—Barreling and Bagging Calcium Nitrate (Norwegian Saltpeter), the Main Product of Norway's Nitrogen Industry

for the operation of this plant, a lake high up in the mountains has been dammed (see Fig. 10), giving a storage reservoir of about 800,000,000 cu.m. of water. Water is led from this storage through a tunnel about 3 miles in length along the mountain side to the inlet of the first power station, Vermork, which is shown in Fig. 2. This station is situated at the upper end of the narrow valley in which Rjukan is located and generates somewhat more than 200,000 kw. The water from the Vermork station is then led through another tunnel about 3½ miles in length along the mountain side to the second power station, Saaheim (Fig. 3), where approximately the same quantity of power is generated.

Fixation Processes

The arc process of nitrogen fixation consists, as is well known, in rapidly passing air through a zone of exceedingly high temperature produced in an electric arc furnace; cooling the hot furnace gases containing the nitric oxide thus produced; recovering heat in waste-heat boilers and economizers; and absorbing the nitrogen dioxide—formed on cooling the nitric oxide in the presence of the accompanying oxygen—in water to produce dilute nitric acid, which is the direct product of the arc process.

Two types of arc furnaces are in use in the Norwegian plants, the Birkeland-Eyde and the Schönherr. The installation at Notodden includes both types; that at Rjukan I is almost exclusively the Schönherr (see Fig. 6), while at Rjukan II, the latest and most modern installation, only Birkeland-Eyde furnaces are used.

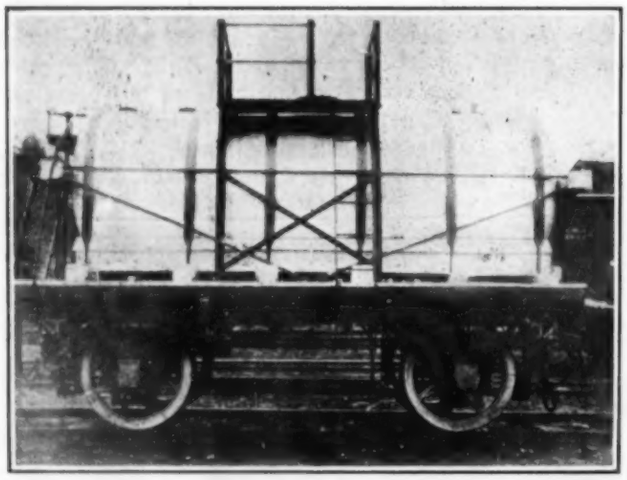


Fig. 9—Aluminum Tank Car (Capacity 10 Tons) Used in Norway for Transporting Nitric Acid

These are shown in Fig. 4, with boilers for heat recovery from the furnace gases at the right. Three steam turbo-generators of 10,000 kw. each are operated at this plant on the steam thus generated. The energy efficiency of the two types of furnaces is approximately the same. The Birkeland-Eyde furnaces yield a concentration of nitric oxide of about 1.25 per cent, as compared with 1.7 per cent for the Schönherr, but the former is installed in units of 4,000 kw., as against 800 to 1,000 kw. for the latter, and hence possesses some operating advantages.

After the oxidation of nitric oxide to nitrogen dioxide has been completed, the gases pass to the absorption system, which consists of many units of five absorption towers in series, three acid towers and two alkaline towers. In the former, 80 to 82 per cent of the nitrogen oxides are obtained in the form of approximately 30 per cent HNO_3 and in the latter 15 to 17 per cent is obtained as sodium nitrite or nitrate or both, depending on the conditions of operation. About 3 per cent of the nitrogen oxides are unabsorbed and escape into the atmosphere. Two granite towers for acid absorption are shown in Fig. 5.

Nitrate Production

The main product of the Norwegian nitrate industry is calcium nitrate, produced by treating limestone with dilute nitric acid, concentrating the solution by means of steam generated from the furnace gas until it contains approximately 13 per cent nitrogen, solidifying the viscous solution on cooling rolls and crushing to granules suitable for fertilizer use. The product is dark gray in color, and, contrary to the general belief, is not basic calcium nitrate, but normal calcium nitrate containing three molecules of water [$Ca(NO_3)_2.3H_2O$]. Owing to the hygroscopicity of this material, it is necessary to provide special containers for it. Formerly all of the nitrate was packed in moisture-proof casks, or barrels, but during the past few years burlap bags with paper lining have been very successfully used with considerable saving in packaging costs. The barreling and bagging operations are seen in Fig. 8.

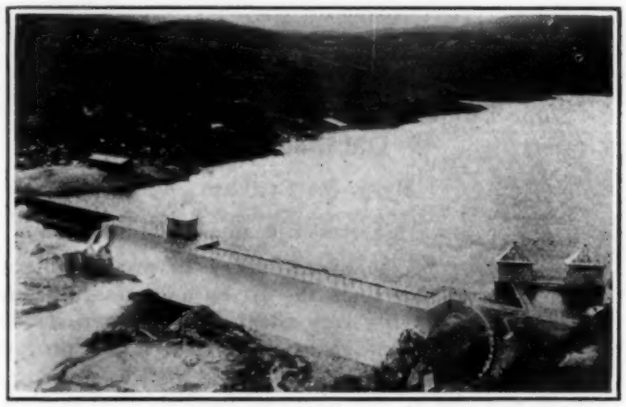


Fig. 10—The Dam at Mjosvand, Near Rjukan I, Where 800,000,000 Cu.M. of Water Is Stored

The present annual output of calcium nitrate, commercially referred to as Norwegian saltpeter, is approximately 160,000 tons. It is marketed to some extent in nearly all of the European countries and also in Egypt and the United States, but nearly half of the output goes to Denmark, where it is displacing Chilean nitrate.

The sodium nitrite and nitrate obtained from the alkaline absorption towers constitute, as previously mentioned, 15 to 17 per cent of the total nitrogen fixed. Both of these salts are exported for use in the chemical industry.

A small part of the output of the Norwegian plants is in the form of concentrated nitric acid. A unique feature in connection with the transportation of the concentrated acid in Norway is the use of aluminum tank cars. Such a car is shown in Fig. 9.

Owing to the low cost of electric power and the fact that the cost of construction of the Norwegian nitrate plants has now been practically written off, it appears probable that the nitrate industry in Norway can continue in successful competition with other fixation processes and with Chilean nitrate.

Cost of Atomizing Fuel Oil

A Comparison of the Cost of Atomizing Fuel Oil With Five Types of Apparatus

By Chaplin Tyler
Of the Editorial Staff of *Chem. & Met.*

AN INTELLIGENT economic comparison of fuels presupposes a knowledge of the cost of preparing them for combustion. With ordinary coal furnaces, this cost comprises handling and stoking charges, plus the cost of ash removal. If powdered coal burners are used, there is an equivalent charge for handling, crushing and pulverizing the fuel. With fuel oil, however, preparation cost is more complicated on account of the diversity of equipment and methods of atomization. In this calculation of the cost of atomizing fuel oil, the following conditions were assumed:

1. Equipment Cost. From a questionnaire sent to twenty-four manufacturers of fuel oil burner equipment, the following over-all costs were calculated:

Hp.	Mechanical Atomizing System	Steam and Air Atomizing System
150	$5,000	$3,000
300	7,000	4,000
900	15,000	9,000
1,950	23,000	14,000
4,500	45,000	30,000

These figures include the cost of burners, strainers, duplex pumps, heaters, underground storage tank, all necessary piping, valves, fittings and meters, together with the cost of installation under average conditions.

2. Fixed Charges and Maintenance. A total of 22 per cent on the initial investment is charged, as follows:

	Per Cent
Interest on the investment	6
Depreciation, mean	10
Taxes and insurance	3
Maintenance and repairs	3
Total	22

3. Cost of Steam. If steam is used for atomization, 2.5 per cent of the total steam generated by the boiler is consumed. Steam for atomization is a charge against the gross boiler efficiency.

Table I—Cost of Atomizing Fuel Oil

	Mechanical Atomizing	Steam Atomizing	Air Atomizing 8-Oz. Pressure	Air Atomizing 2-Lb. Pressure	Air Atomizing 80-Lb. Pressure
150 hp. = 1,000 gal. per day					
Air cost	.....	.....	$1.16	$2.53	$5.80
Steam cost or power cost	$0.48	$2.48	.....	.....	.....
Fixed charges	3.67	2.20	2.20	2.20	2.20
Total	$4.15	$4.68	$3.36	$4.73	$8.00
300 hp. = 2,000 gal. per day					
Air cost	.....	.....	2.32	5.06	11.60
Steam cost or power cost	0.96	4.96	.....	.....	.....
Fixed charges	5.13	2.93	2.93	2.93	2.93
Total	$6.09	$7.89	$5.25	$7.99	$14.53
Cost per 1,000 gal. oil	3.05	3.95	2.63	4.00	7.27
900 hp. = 6,000 gal. per day					
Air cost	.....	.....	6.96	15.18	34.80
Steam cost or power cost	2.88	14.88	.....	.....	.....
Fixed charges	11.10	6.60	6.60	6.60	6.60
Total	$13.98	$21.48	$13.56	$21.78	$41.40
Cost per 1,000 gal. oil	2.33	3.58	2.26	3.63	6.90
1,950 hp. = 13,000 gal. per day					
Air cost	.....	.....	15.08	32.89	75.40
Steam cost or power cost	6.24	32.24	.....	.....	.....
Fixed charges	16.87	10.26	10.26	10.26	10.26
Total	$23.11	$42.50	$25.34	$43.15	$85.66
Cost per 1,000 gal. oil	1.78	3.27	1.95	3.32	6.59
4,500 hp. = 30,000 gal. per day					
Air cost	.....	.....	34.80	75.80	174.00
Steam cost or power cost	14.40	74.40	.....	.....	.....
Fixed charges	33.00	22.00	22.00	22.00	22.00
Total	$47.40	$96.40	$56.80	$97.80	$196.00
Cost per 1,000 gal. oil	1.58	3.21	1.89	3.26	6.53

4. Cost of Air. This was calculated from a summary of performance for various types of blowers:

Machine Type	Fan	Displacement Turbine	Piston Compressor
Delivery pressure	8 oz.	2 lb.	80 lb.
Anticipated induction of atmospheric air, per cent	36	50	88
Cu.ft. of compressed air necessary to burn 1 gal. fuel oil per minute	960*	480	180
Energy necessary to compress above volume of air, kw.	3.55	7.6	17.4
Power cost-air for 1,000 gal. fuel oil at 2c. per kw.-hr.	$1.16	$2.53	$5.80

* Required 1,500 cu.ft. free air per gallon of oil for complete combustion.

5. Operation. On the basis of 24 hours per day, 300 days per year, 1,000 gal. of oil per day is used in a 150-hp. plant, assuming:

a. Oil.....7.85 lb. per gal.
b. Oil.....19,000 B.t.u. per lb.
c. Boiler efficiency....80 per cent at full load

6. Labor. No charge for labor is included in the cost of atomizing oil.

Table I gives the cost items as calculated on the basis of the foregoing data. From this table, the cost of atomizing 1,000 gal. of oil is plotted against equipment capacity, as shown by Fig. 1.

A study of the curves in Fig. 1 will show that the size of the plant has but little effect on the cost of atomizing oil. This is because the expense items of atomization, with the exception of fixed charges on the plant, are directly proportional to the quantity of oil atomized. Another important point is that in no case is the cost of atomizing fuel oil a determining factor in the choice of fuels. Fluctuation in the price of fuel oil is the big factor. For example, a change of 1c. in the price of oil is relatively important, as compared to the cost of atomization.

Choice of equipment is governed largely by operating conditions. In a small plant, operated constantly at a normal load, a steam atomizing system will give a high efficiency, and at a comparatively small initial capital investment. Steam atomizing systems are relatively inflexible, however, and at high loads are not as efficient as are mechanical atomizing systems. Thus the greater initial investment of the latter type is often justifiable.

Thanks are due Prof. R. T. Haslam of the Massachusetts Institute of Technology for valuable aid in the preparation of this paper.

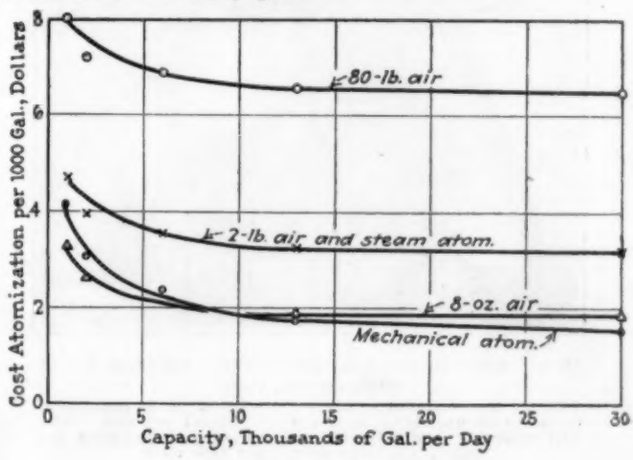


Fig. 1—Cost of Atomizing Fuel Oil

Some Signs of Progress in Oil-Shale Development

A Californian Company Finds a Source of Petroleum in Oil-Impregnated Diatomite

A PLANT for the recovery of petroleum and byproducts from an impregnated diatomite has recently been completed and put into operation at Sherman Cut, near Casmalia, Santa Barbara County, California. The deposit is to be mined by open-cut methods, following the stripping of overburden. The diatomite stratum extends toward Sherman Cut from a considerable depth at the Santa Maria Oilfield a few miles distant, and it is supposed that capillarity has been responsible for the impregnation of the material with petroleum.

The raw material is crushed to about 3 in., and classified for the discard of minus ½-in. fines by vibrating screens. The oversize is fed to a retort, 40 ft. high and 10 ft. in diameter, arranged for continuous operation. Firing is in an upward direction, but no external heat is necessary, the combustion of the raw material providing what is necessary. The temperature in the retort is maintained at from 1,600 to 1,750 deg. F. A feature of operation is the addition of superheated steam.

Research is being conducted to develop and find a market for several byproducts of retorting, as well as for the utilization of the screened fines from the plant. The crude petroleum is piped from the retort a distance of about 3 miles to the Southern Pacific R.R., for transportation to the seaboard refineries of the Associated Oil Co. The maximum output of the retort is about 100 bbl. per day. The officials of the Continental Shale Products Co. comprise U. C. Winton, president and general manager; Dr. David T. Day, chief chemist and vice president; Dr. H. K. Ihrig, general superintendent, and Charles Lupher, mining engineer.

Retort, With Control House Beneath

Retort Used by the Continental Shale Products Co. at Sherman Cut, Calif.

This is an internally heated retort with a maximum capacity of approximately 100 bbl. of oil per day. The belt conveyor and automatic equipment for charging the retort are to be seen from this view.

Experimental Steam Retort at Colorado Station of Bureau of Mines Shows An Interesting Trend of Development

THERE has recently been developed at the Boulder, Colo., field office of the Bureau of Mines an experimental oil-shale retort that embodies a number of interesting features of design and construction. This retort, which has been finished to an extent that has permitted several trial runs, is essentially an element of the Pumpherston retort that is so largely used in Scottish oil-shale industry.

The material to be retorted is fed downward through the retort, and superheated steam at a temperature of about 1,200 F. is admitted at the bottom of the retort. The superheat from the steam is transferred to the material by countercurrent flow. Bins are so arranged at the top and bottom of the retort that the process can be made continuous, and the feed mechanism is so controlled that it is possible to have a range of passage of material through the retort of from 15 to 50 lb. per hour. The rate of feed of material through the retort will depend upon the capacity of the superheater, the percentage of volatile matter to be removed from the retorted material, conductivity and heat consumption of the material, and the richness of the material being retorted.

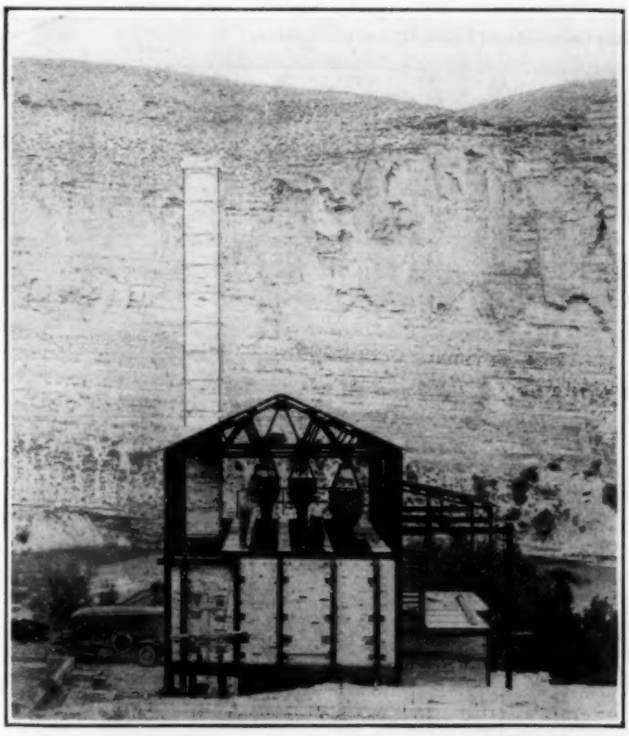
A heat recovery scheme has been provided for recovering the heat from the spent shale. The superheater used in connection with the retort has a capacity of about 30 lb. of steam per hour from 210 to 1,300 deg. F.

The steam and oil vapors leave the retort at about 300 deg. F. To control operating conditions and to show transfer of heat through the retorted material, ten base metal thermocouples were placed throughout the length of the retort, superheater and superheater combustion chamber. The retort is purely a laboratory apparatus from which it is hoped to obtain some of the important physical and chemical data that will greatly expedite design and reduce the cost of larger installations that must be constructed and operated before definite recommendations can be made for commercial practice.

Arthur D. Bauer, associate petroleum technologist, is in charge of the oil-shale laboratory of the Bureau of Mines, which is maintained in co-operation with the State of Colorado at Boulder. W. L. Finley, J. W. Horne and D. W. Gould are co-operative employees associated in this work. Lewis C. Karrick, consulting petroleum engineer of the Bureau of Mines and now located at the Pittsburgh station, had charge of the design and construction of the experimental steam retort.

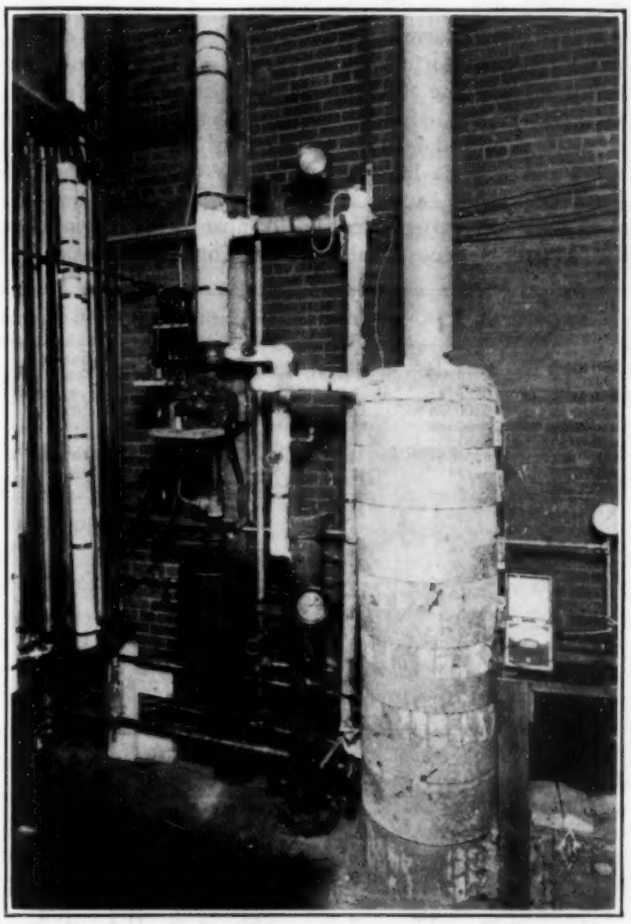
An Oil-Shale Development in Utah That Failed to Reach Completion

DURING 1918 the Ute Oil Co. began an oil-shale development near Watson, Utah, on what appeared to be a larger scale than had ever before been attempted in this country. It was planned to erect a 400-ton retorting plant with complete accessories for refining the oil produced. Contracts were let for the erection of the plant, and the Russell Engineering Co. of St. Louis carried the construction to perhaps one-third completion. Since that time no attempt has been made to finish the plant, although the local manager, T. J. Davis, has carried on assessment and development work in connection with the shale property.



Oil-Shale Development Near Watson, Utah
This retorting plant on the banks of the White River and in the center of an area of rich shale was originally designed to handle 400 tons per day. Construction was never completed, however, and the plant has stood in its present condition for several years.

The retorts, which were designed by G. W. Wallace, are about 14 ft. long and 15 in. in diameter, slightly tapering outward at the base. Inside each retort is a hollow, perforated iron core through which the vapors are withdrawn by suction and forced into condensers and scrubbers. The retorts, set vertically in a brick furnace, were to be heated externally by gas from a separate producer which had been built into the retorting plant. It was originally planned to pump the shale oil produced to a refinery to be built on a level site some distance above the retorts. An elaborate arrangement was provided for dumping the spent shale out into the stream bed of the White River, which is but a few hundred feet from the retorting plant.



An Experimental Retort at the Bureau of Mines, Boulder, Colo.
Interesting features of this small-scale unit include the use of superheated steam as the heating medium and the provision of a heat recovery system to conserve heat from the spent shale.

EDITOR'S NOTE: The brief descriptions that appear on these pages complete the series of articles on American oil-shale development which were introduced last October in the general discussions of this subject by S. D. Kirkpatrick of *Chem. & Met.'s* editorial staff. The latter's articles appeared in our issues of Oct. 20, 1924 (pp. 610-5), Oct. 27, 1924 (pp. 651-5), Nov. 3, 1924 (pp. 688-92), Nov. 17, 1924 (pp. 770-5), and Dec. 8, 1924 (p. 884-5). An article by G. W. Wallace appeared in *Chem. & Met.* Feb. 9, 1925 (pp. 237-9). Further developments of industrial interest will be recorded as progress is made in this branch of technology.

Partial Vapor Pressures of Aqueous HCl Solutions

A Consolidation of the Reliable Literature and Criticism of Hurter's Formula for Calculating Partial Pressures of HCl

By Fred C. Zeisberg
Chemical Department, E. I. du Pont de Nemours & Co.

IN 1889, Hurter (*J. Soc. Chem. Ind.*, vol. 8, p. 861) published a formula for the partial pressure of HCl out of hydrochloric acid solutions. This formula was derived from the data of Roscoe and Dittmar (*Ann.*, vol. 112, p. 327, 1859). Comment on a piece of work so ancient would be unnecessary but for the fact that Hurter's formula has gained wide recognition through the writings of Lunge and others, and is still used by designers of hydrochloric acid absorption apparatus. Hurter claimed no great accuracy for his formula, but a comparison of results obtained from it with the results of the present work shows a discrepancy that should be mentioned.

Hurter's formula is

$$P = \sqrt[0.15]{\frac{C}{0.304 - 0.0016\,t}}$$

where P = pressure of HCl in mm. mercury
C = weight in gm. of HCl absorbed by 1 gram of water at temperature of expt.
t = temperature in deg. C.

and by means of it, the values shown in Table I were calculated. For comparison, values read from Table III are shown.

From this table it is obvious that Hurter's formula is approximate only for 25 to 30 per cent HCl at 60 deg. C., and that under other conditions it is unreliable and should be discarded.

A general formula has been developed for the HCl partial pressure of aqueous solutions, and the error is

Table I—Comparison of Hurter's Formula With Experimental Data From All Sources

Temp. Deg. C.	10 Per Cent HCl: Hurter Formula	10 Per Cent HCl: Actual Pressure	10 Per Cent HCl: Per Cent Error	20 Per Cent HCl: Hurter Formula	20 Per Cent HCl: Actual Pressure	20 Per Cent HCl: Per Cent Error	30 Per Cent HCl: Hurter Formula	30 Per Cent HCl: Actual Pressure	30 Per Cent HCl: Per Cent Error
0	0.00122	0.00042	+190	0.272	0.0316	+760	9.88	2.40	+310
20	0.00256	0.00390	—35	0.570	0.205	+180	20.7	10.6	+95
40	0.00589	0.0282	—88	1.31	1.06	+24	47.7	39.4	+21
60	0.0153	0.157	—91	3.41	4.40	—22	124	124	0
80	0.0466	0.73	—94	10.38	15.60	—33	377.5	340	+11
100	0.177	2.9	—94	39.56	49.00	—19	1438.7	845	+70

Table II—Comparison of Zeisberg's Formula With Experimental Data From All Sources

Weight Per Cent HCl	0 Deg. C.: Zeisberg Formula	0 Deg. C.: Actual Pressure	0 Deg. C.: Per Cent Error	50 Deg. C.: Zeisberg Formula	50 Deg. C.: Actual Pressure	50 Deg. C.: Per Cent Error	100 Deg. C.: Zeisberg Formula	100 Deg. C.: Actual Pressure	100 Deg. C.: Per Cent Error
16	0.00052	0.0056	— 7	0.507	0.550	— 8	14.5	16.2	—10
20	0.0321	0.0316	+1.6	2.21	2.23	+0.9	49.8	49.5	0.6
30	2.33	2.39	—2.5	69.0	71.0	—2.8	825	845	—2.4
32	5.24	5.7	—8	.....	.....	.....	.....	.....	.....
36	24.9	28.9	—14	443	535	—17	.....	.....	.....
40	113	131	—14	573*	655*	—14	.....	.....	.....

* 30 deg. C., not 50 deg. C.

Table III—Water Vapor Pressure of HCl Solutions Consolidated From All Reliable Sources

Per Cent HCl in Soln.	Vapor Pressure in mm. Hg: 0 Deg.	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110
6	4.18	6.04	8.45	11.7	15.9	21.8	29.1	39.4	50.6	66.2	86.0	139	220	333	492	715	...
10	3.84	5.52	7.70	10.7	14.6	20.0	26.8	35.5	47.0	61.5	80.0	130	204	310	463	677	960
14	3.39	4.91	6.95	9.65	13.1	18.0	24.1	31.9	42.1	55.5	72.0	116	185	273	425	625	892
18	2.87	4.21	5.92	8.26	11.3	15.4	20.6	27.5	36.4	47.9	62.5	102	162	248	374	550	783
20	2.62	3.83	5.40	7.58	10.3	14.1	19.0	25.1	33.3	43.6	57.0	93.5	150	230	345	510	729
22	2.33	3.40	4.82	6.75	9.30	12.6	17.1	22.8	30.2	39.8	52.0	85.6	138	211	317	467	670
24	2.06	3.04	4.31	6.03	8.30	11.4	15.4	20.4	27.1	35.7	46.7	77.0	124	194	290	426	611
26	1.76	2.60	3.71	5.21	7.21	9.95	13.5	18.0	24.0	31.7	41.5	69.0	112	173	261	388	554
28	1.50	2.24	3.21	4.54	6.32	8.75	11.8	15.8	21.1	27.9	36.5	60.7	99.0	154	234	349	499
30	1.26	1.90	2.73	3.88	5.41	7.52	10.2	13.7	18.4	24.3	32.0	53.5	87.5	136	207	310	444
32	1.04	1.57	2.27	3.25	4.55	6.37	8.70	11.7	15.7	21.0	27.7	46.5	76.5	120	184	275	396
34	0.85	1.29	1.87	2.70	3.81	5.35	7.32	9.95	13.5	18.1	24.0	40.5	66.5	104	161	243	355
36	0.68	1.03	1.50	2.19	3.10	4.41	6.08	8.33	11.4	15.4	20.4	34.8	57.0	90.0	140	212	311
38	0.53	0.81	1.20	1.75	2.51	3.60	5.03	6.92	9.52	13.0	17.4	29.6	49.1	77.5	120	182	266
40	0.41	0.63	0.94	1.37	2.00	2.88	4.09	5.68	7.85	10.7	14.5	25.0	42.1	67.3	105	158	230
42	0.31	0.48	0.72	1.06	1.56	2.30	3.28	4.60	6.45	8.90	12.1	21.2	35.8	57.2	89.2	135	195

Table IV—Partial Pressure of HCl Over Its Aqueous Solutions Consolidated From All Reliable Sources

Per Cent HCl	Vapor Pressure in mm. Hg: 0 Deg.	5	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110
2	.....	.....	0.0000117	0.000023	0.000044	0.000084	0.000151	0.000275	0.00047	0.00083	0.00140	0.00380	0.0100	0.0245	0.058	0.132	0.280
4	0.000018	0.000036	0.000069	0.000131	0.00024	0.00044	0.00077	0.00134	0.0023	0.00385	0.0064	0.0165	0.0405	0.095	0.21	0.46	0.93
6	0.000066	0.000125	0.000234	0.000425	0.00076	0.00131	0.00225	0.0038	0.0062	0.0102	0.0163	0.040	0.094	0.206	0.44	0.92	1.78
8	0.000118	0.000323	0.000583	0.00104	0.00178	0.0031	0.00515	0.0085	0.0138	0.022	0.0344	0.081	0.183	0.39	0.82	1.64	3.10
10	0.00042	0.00075	0.00134	0.00232	0.00395	0.0067	0.0111	0.0178	0.0282	0.045	0.069	0.157	0.35	0.73	1.48	2.9	5.4
12	0.00099	0.00175	0.00305	0.0052	0.0088	0.0145	0.0234	0.037	0.058	0.091	0.136	0.305	0.66	1.34	2.65	5.1	9.3
14	0.0024	0.00415	0.0071	0.0118	0.0196	0.0316	0.050	0.078	0.121	0.185	0.275	0.60	1.25	2.50	4.8	9.0	16.0
16	0.0056	0.0095	0.016	0.0265	0.0428	0.0685	0.106	0.163	0.247	0.375	0.55	1.17	2.40	4.66	8.8	16.1	28
18	0.0135	0.225	0.037	0.060	0.095	0.148	0.228	0.345	0.515	0.77	1.11	2.3	4.55	8.6	15.7	28	48
20	0.0316	0.052	0.084	0.132	0.205	0.32	0.48	0.72	1.06	1.55	2.21	4.4	8.5	15.6	28.1	49	83
22	0.0734	0.119	0.187	0.294	0.45	0.68	1.02	1.50	2.18	3.14	4.42	8.6	16.3	29.3	52	90	146
24	0.175	0.277	0.43	0.66	1.00	1.49	2.17	3.14	4.5	6.4	8.9	16.9	31.0	54.5	94	157	253
26	0.41	0.64	0.98	1.47	2.17	3.20	4.56	6.50	9.2	12.7	17.5	32.5	58.5	100	169	276	436
28	1.0	1.52	2.27	3.36	4.90	7.05	9.90	13.8	19.1	26.4	35.7	64	112	188	309	493	760
30	2.4	3.57	5.23	7.60	10.6	15.1	21.0	28.6	39.4	53	71	124	208	340	542	845	.....
32	5.7	8.3	11.8	16.8	23.5	32.5	44.5	60.0	81	107	141	238	390	623	970	.....	.....
34	13.1	18.8	26.4	36.8	50.5	68.5	92	122	161	211	273	450	720	.....	.....	.....	.....
36	29.0	41.8	56.4	78	105.5	142	188	246	322	416	535	860	.....	.....	.....	.....	.....
38	63.0	87.0	117	158	210	277	360	465	598	758	955	.....	.....	.....	.....	.....	.....
40	130	176	233	307	399	515	627	830	.....	.....	.....	.....	.....	.....	.....	.....	.....
42	253	332	430	560	709	900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
44	510	655	840	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
46	940	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

less than 5 per cent in the range from 18 to 32 per cent HCl, and from 0 to 100 deg. C. This formula is

$$\log P = 10.9528 - 0.009725\,W - 0.000868\,W^2 - \frac{4.557 - 65.3\,W}{T}$$

where P = pressure of HCl in mm. mercury
W = weight per cent of HCl in solution
T = absolute temperature in deg. C.

From Table II it is evident that the formula developed in this report is much more accurate than that of Hurter, and is sufficiently accurate for all ordinary engineering work, at least from 15 to 40 per cent HCl by weight, and at ordinary operating temperatures.

Temperature of Vapor Above Boiling Salt Solutions

A Triangular Discussion Contributed by Bahlke and Wilson, Badger and Harker

In the Aug. 25, 1924, issue of Chem. & Met. there appeared an article by K. Schreber translated by W. L. Badger on the "Temperature of Vapor Above Boiling Salt Solutions." Schreber concludes that the vapor temperature is the same as that of the pure boiling solvent, and not that of the boiling salt solution. G. Harker thoroughly disagrees with Schreber's conclusions, as do W. H Bahlke and R. E. Wilson, who have prepared an excellent discussion of the subject. We are glad to be able to publish data that we believe to be conclusive and on a subject that has remained unsettled for more than 100 years.

Bahlke and Wilson Have Experimental Evidence Controverting Schreber's Work

By W. H. Bahlke and Robert E. Wilson
Research Laboratory Standard Oil Co. (Indiana).

RECENTLY W. L. Badger published (*Chem. & Met.*, 1924, vol. 31, p. 297) a translation and summary of several papers by K. Schreber that described experiments indicating that the temperature of the vapors leaving a boiling salt solution was not the same as that of the solution, but instead represented the boiling or condensing temperature of the pure solvent at that pressure. Although these experiments appeared to have been conducted with care, and were deemed entirely conclusive by the translator, the conclusion reached does so much violence to accepted theories that the writers felt that both the experiment and the attempted explanation needed to be examined with great care. To indicate the inherent improbability of the proposition it is merely necessary to point out briefly that:

(*a*) In designing multiple effect evaporators, chemical engineers have long recognized the fact that the vapors leaving a boiling salt solution are superheated and that this superheat must be removed before condensation can begin (see Walker, Lewis and McAdams, "Principles of Chemical Engineering," pp. 401-2).

(*b*) A fundamental principle of kinetic theory is that in any system at equilibrium the average kinetic energy, and hence temperature, of any large group of molecules must be the same, regardless of whether they are in the liquid or the vapor state. Individual vaporizing molecules leaving either a pure solvent or a salt solution give up a portion of their energy in overcoming the attraction of the other molecules in the liquid, but this loss is exactly compensated by the fact that none of the more slowly moving molecules can escape from the solution at all, and the final average velocity of the same kind of molecules in each phase is identical (see for example, Boynton, "Kinetic Theory," pp. 154-64).

(*c*) The second law of thermodynamics could easily be violated if the vapor in equilibrium with a solution were at a different temperature. Assume, for example, a system comprising a salt solution at its boiling point, say 150 deg. C., in contact with a reservoir of heat at the same temperature, and vapor above the liquid is a perfectly lagged cylinder with a lagged piston resting on the vapor. Now if the vapor were at a temperature of 100 deg. C., and a sheet of metal were suddenly interposed between the liquid and the vapor, preventing any contact between them, the metal would at once come to a temperature of 150 deg. C. and the vapor above it would be heated by conduction to the same temperature, causing the piston to rise and do work against the atmosphere and other force if desired. Removal of the metal plate would then change the equilibrium temperature back to 100 deg. C., the piston meanwhile falling back to its original position. Work could thus be done without any change in state and solely at the expense of heat from the surroundings at constant temperature. This would be a clear violation of the second law, in addition to the obvious improbability that the insertion of an inert partition into a system at equilibrium could change that equilibrium.

The explanation offered by Schreber in support of his observations really had no bearing on the question of the temperature of the vapor in equilibrium with the solution, but was directed to explaining, and incorrectly, the really unrelated fact that a saturated vapor will heat a salt solution to its boiling point, which temperature is above that of the saturated vapor. This is really not a bit more surprising than that cold water added to warm sulphuric acid increases rather than decreases the temperature of the latter. In both cases the two substances are not at equilibrium at the start, and evolve a considerable amount of heat when they are combined. In the case of the water vapor, the main factor is of course the heat of condensation, and the presence of the salt merely keeps condensation going on even after the solution has been heated above the vapor temperature. Exactly the same thing would happen in the case of pure water vapor being adsorbed by activated charcoal. The elaborate explanations offered are irrelevant and neither of the two hypotheses contradicts the second law of thermodynamics, because the initial and final states of the system are in neither case the same.

Considering then the experimental work of Schreber critically, although in most respects it was apparently careful, there are two criticisms that should not be overlooked in the interpretation of his results. First, he used a solution that boiled only 8 deg. C. above the boiling point of water, and second, he used a limited amount of solution, so that his experiments could be conducted for a limited period of time only. The amount of heat available in water vapor from 100 to 108 deg. C. is so small when compared with the other

heat capacities of his system that it would be very difficult to detect this amount of superheat. In view of these criticisms it seemed advisable to determine the temperature of the vapors of a solution that boiled several times as much above the boiling point of water in an apparatus that could run continuously so that ample time could be allowed to attain equilibrium. Accordingly, the authors constructed the apparatus shown in Fig. 1, using as the solution phase a solution of zinc chloride that boiled at 152 deg. C. This solution was boiled in the flask *A* and the vapors were made to pass through two thicknesses of wire gauze *B* that completely inclosed the thermometer *C* and protected it from splashes of solution. The vapors were forced to pass through the gauze by means of the tight fitting ring *D*. The evolved water vapor was condensed in the condenser *E* and returned to the flask through *F*. In some of the experiments, an asbestos jacket *G* was placed around the apparatus so that the outside temperature could be regulated. Before the vapor temperature was measured, the temperature of the boiling solution was determined by removing the stopper, gauze and thermometer and inserting another thermometer in the boiling solution.

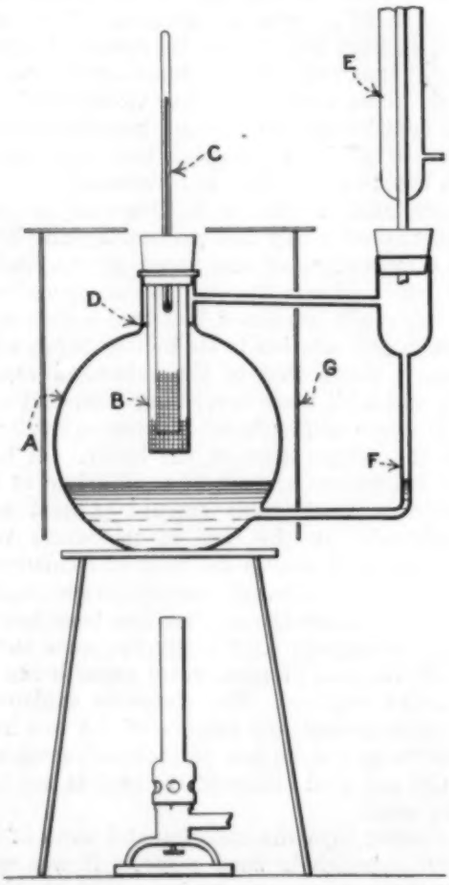


Fig. 1—Apparatus for Measuring Temperature of Vapor Above Boiling Salt Solutions

This ingenious apparatus was designed by Bahlke and Wilson for determining the temperature of aqueous vapor above a boiling concentrated zinc chloride solution. A special feature is the double wire gauze that protects the thermometer from spray and radiation.

With this apparatus the following results were obtained: When boiling was first started, the temperature rapidly rose to about 100 deg. C., remaining at this point for a considerable time while a film of condensed water was slowly evaporated, and then began to rise gradually until eventually an approximate equilibrium at about 135 deg. was reached. With the shield removed and repeating the above procedure with the surrounding air at 56 deg., the temperature finally attained was 124 deg. When the thermometer was heated above 152 deg. and inserted while the solution was boiling vigorously, the temperature fell rapidly to 140 deg. and from then on decreased slowly until an apparent equilibrium was reached at 126 deg. All these readings were taken with the solution boiling vigorously. A decrease in the rate of formation of vapors would cause a drop in the equilibrium temperature, due to the fact that the outside temperature was different from that on the inside and as the quantity of heat radiated per unit surface is practically constant for various rates of boiling, the smaller the amount of the vapors the larger their temperature drop before reaching the thermometer.

Schreber attempted to explain some observations of high vapor temperatures on the basis that some of the solution splashed on the thermometer. During most of the experiments of the writers the thermometer could be observed and the formation of a drop on the thermometer would have been quickly detected. Only during the early part of an experiment were any drops observed. These soon disappeared as the experiment was continued. After each experiment the thermometer was washed off with distilled water and tests for zinc and chlorine were made on the washings. Experiments were not considered reliable unless a negative test was obtained. With the thermometer well up in the neck of the flask and protected by two layers of wire gauze, the solution could be boiled quite vigorously without transferring solution to the thermometer.

That the temperature of the vapors depends considerably upon the outside temperature is shown by the fact that if the outside temperature was increased to about 152 deg., the vapor temperature quickly rose to about 150 deg. It seems quite certain, then, from these experiments that the temperature of the vapors evolved from a boiling salt solution is the same as that of the solution, although it is very difficult to measure it except in a continuous distillation with the temperature of the surroundings carefully controlled. Such a conclusion is, as stated in the early paragraphs, in agreement with both the kinetic theory and the laws of thermodynamics, while the opposite conclusion cannot be satisfactorily explained on the basis of either.

An interesting and related observation on the effect of radiation in causing errors in the measurement of vapor temperatures was recently made in this laboratory. In the distillation of an alcohol-water mixture a thermometer in the stream of the evolved vapors registered a temperature of 110 deg. C. and was apparently little affected by the rate at which the solution was boiled. The temperature of the liquid showed 91 deg. It happened that in this apparatus the usual wire gauze was a short distance below the flask, so that an area possibly 2 in. in diameter was at a red heat. Removal of the wire gauze caused immediate alteration to the correct temperature and reinsertion would cause a re-

currence of an elevated temperature practically the same as that previously observed. Another gauze heated to a similar temperature about 4 in. to one side of the flask produced a similar rise in the temperature indicated by the thermometer. This high temperature radiation evidently swamped the smaller cooling radiation observed in the cases discussed previously. These effects could not be reproduced in the case of zinc chloride solutions, probably because this liquid absorbed most of the infra-red rays.

Harker Believes That Vapor Has Same Temperature as the Boiling Solution

By George Harker, Sc.D.
University of Sydney, New South Wales

MY ATTENTION has been drawn to an article in your journal in the Aug. 25 issue on the subject of the "Temperature of Vapor Above Boiling Salt Solutions," by K. Schreber, translated by W. L. Badger.

I am inclosing a contribution of my own ("The Temperature of the Vapor Arising From Boiling Saline Solutions," *J. Proc. Roy. Soc.*, New South Wales, Vol. LIV), on the same subject, which I thought might possibly interest you, as I arrive at quite a different conclusion from Dr. Schreber. I must say that I find it exceedingly hard to believe that the vapor leaves the solution at a y other temperature but that of the boiling solution. I have sent the two copies of my paper to Dr. Badger, as I thought he might like to forward one to Dr. Schreber.

Schreber's Technique Better Than That of Harker, Says Badger

By W. L. Badger
Professor of Chemical Engineering, University of Michigan

I WAS acquainted with the work of Sakurai, but did not consider it especially important, since considerable heat could be transmitted to the thermometers by the superheated vapor that he introduced. This is shown by the fact that the hotter he got the vapor, the hotter the steam became. Harker's own experimental work, it seems to me, is more successful, but it does not appear that his experimental work was anywhere nearly so thorough as that of Schreber. A simple comparison of Harker's apparatus and Schreber's show how much more careful Schreber was. The principal error that Harker has made is that he has taken no precautions against entrainment. It is true that he says the thermometers were always dry on examination after an experiment, but this is a rather inaccurate method of insuring freedom from entrainment.

It seems to me that the discussion has resolved itself into an actual question of fact. Schreber has described experiments in a more carefully designed apparatus which are not reported in detail but which he states exactly prove one side of the question. Sakurai and Harker have cited experiments in apparatus which is not free from criticism and in which they apparently have substantiated the other side of the question. It seems that it is a matter for definite experimental work and not for further discussion.

Manufacture of Oil Gas

By D. J. Demorest
Professor of Metallurgy, Ohio State University

THE OIL GAS that is made for enriching blue water gas is quite similar to natural gas in composition, being composed largely of hydrocarbons resulting from the thermal decomposition or cracking of petroleum oils, using the heat available from the blasting of a water gas set. Oil gas made in this way is as cheap as such a gas can be, since the heat for the cracking is a byproduct of the water gas process. It has the highest heat value of any manufactured gas, 1,400 to 1,500 B.t.u. per cu.ft.

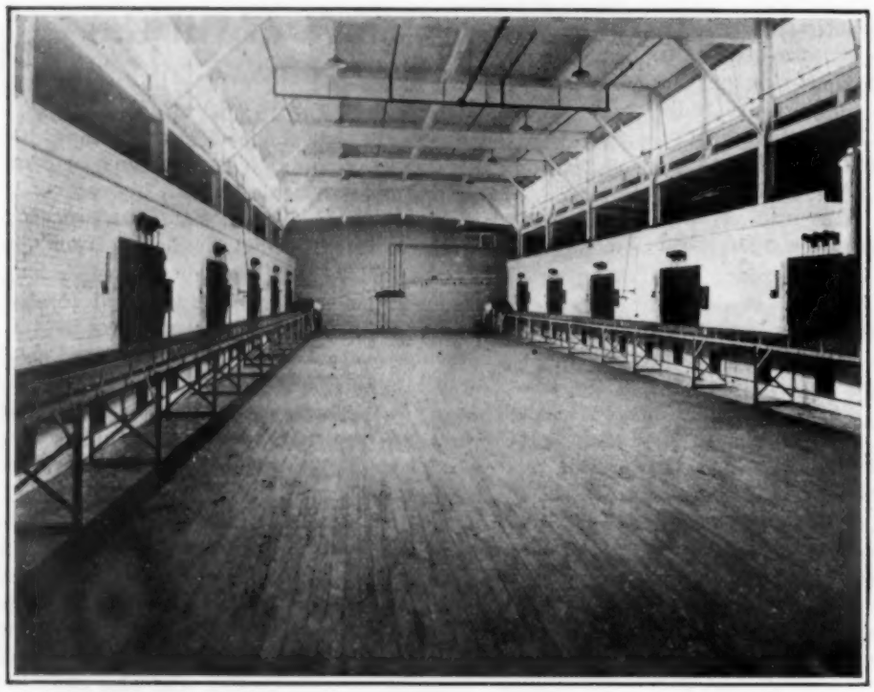
When oil gas is made separate from the water gas process, it is made by either the Dayton process or the checkerwork process. In either of these processes the cost will be greater than when it is made with waste heat from a water gas generator. In the Dayton process air and oil spray are admitted together into a hot chamber, the air burning a part of the oil and producing heat enough to crack the remainder. The product, a mixed air-gas-oil-gas, has a heat value about the same as that of coal gas. This gas, of course, contains all the nitrogen brought in with the air and also contains water and carbon monoxide due to reaction of the oxygen of the air with the oil vapor. The process is said to make gas of about 500 B.t.u. per cu.ft. at a cost of $0.35 per 1,000 cu.ft., not counting interest and depreciation. With interest, depreciation and overhead added, the cost could not be under $0.45 per thousand.

The oil gas made for several cities on the Pacific coast is made by a process similar to that carried on in the carburetor of a water gas set, except that steam is used with the oil in order to gasify some of the carbon that deposits on the checkerwork. This checkerwork is first heated by passing air and oil spray through the already hot passages. Then, when the bricks have been heated to the required temperature, the air is shut off, the generator is purged, and a spray of oil and steam is passed through. The resulting gas is a mixture of oil gas and water gas with a composition very similar to that of coal gas, as is shown from the following analysis of a typical gas made in Portland, Ore.:

	Per Cent		Per Cent
CO_2	1.0	C_2H_6	1.0
C_2H_4	3.8	N_2	2.7
CO	6.8	B.t.u. per cu.ft. =	570.
H_2	59.2	Specific gravity =	0.35.
CH_4	25.4		

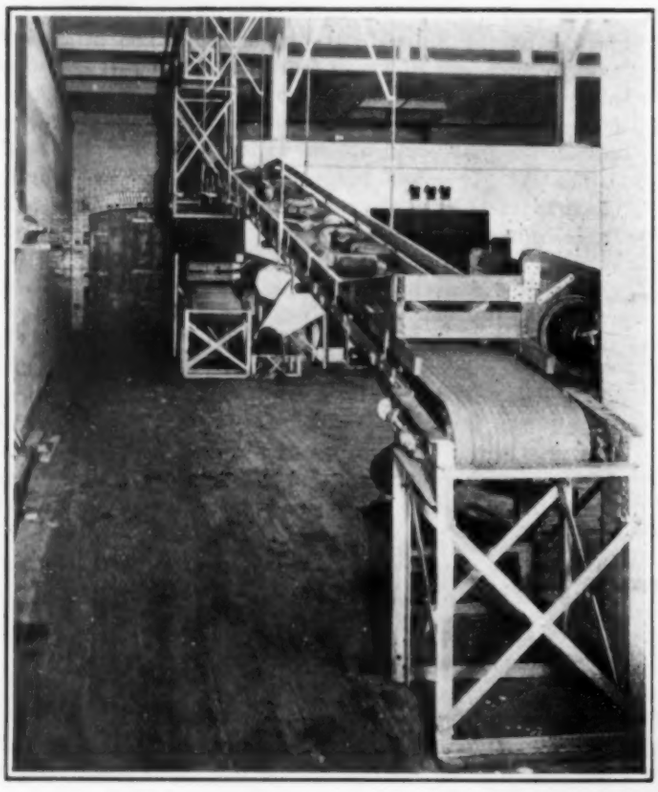
The gasifying efficiency of this process is low, since only about one-fourth of the carbon of the oil gets into the gas, a great deal of the carbon being recovered as lampblack and a considerable amount being burned when the air blast is on. The thermal efficiency when the potential heat of the lampblack is recovered is given as about 72 per cent. This process requires about 8.5 gal. of oil per 1,000 cu.ft. of gas made, while the Dayton process is said to use only 4 gal. of oil per thousand.

The oil gas process is a logical one to use on the Pacific coast, where oil is the only reasonably priced fuel. But in the eastern part of the United States, where coal is relatively cheap and plentiful, while oil is uncertain in supply and relatively expensive, it is not likely that oil gas will be widely adopted, although the first cost of the plant is low, possibly somewhat lower than that of a water gas plant.



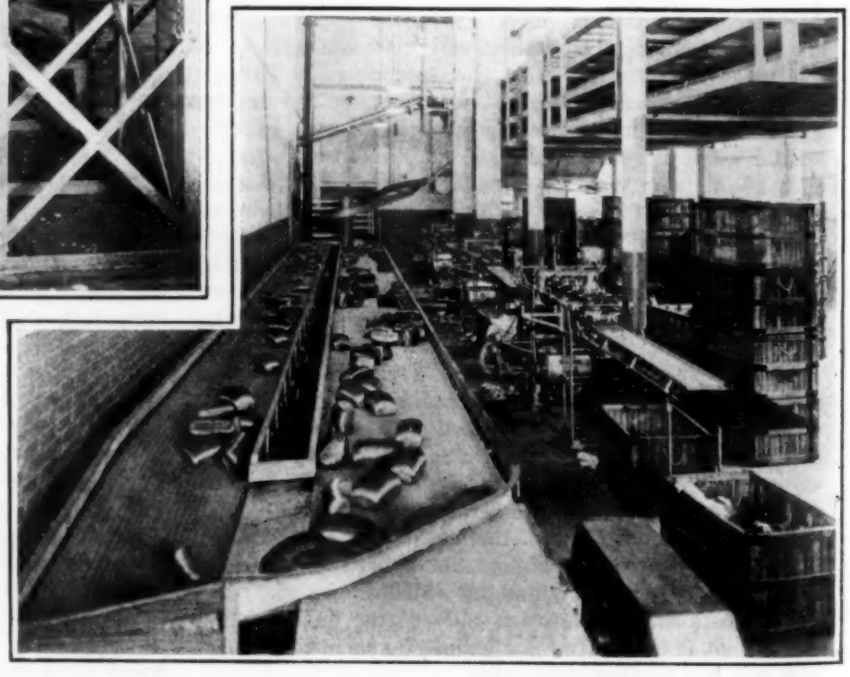
Left above—The two batteries of peel ovens shown here are each served by a flat belt conveyor, onto which the baker dumps the finished bread as he removes it from the oven, so that it is carried away as fast as finished without being touched by human hands.

Left below—The belts serving the peel ovens carry the bread to the end of the room, where it changes to belt conveyors moving at right angles. These latter belts elevate the bread and at the same time transport it to the cooler, which is a series of slat tray conveyors, one over the other.



Killing Two Birds With a Conveying System

THE average plant has inducement enough, in the savings to be made, for the adoption of material handling equipment for handling the product. The food product manufactory has an added inducement, however, in the much greater cleanliness obtainable by substituting machine handling for the work of human hands. The views shown on this page, taken in one of the largest bakeries in America, show how one industry utilizes conveyors for both these purposes.



Right—After the bread has been passed automatically through the cooler, shown in the upper right of this picture, and been cooled sufficiently to prevent sweating in the wrapper, it passes by means of a spiral chute to the collecting belts, from which it is taken by hand, and transferred to the wrapping machine as convenient, the only human handling between the oven and the customer.

Equipment News

From Maker and User

The Visual Comparison of Belt Slip

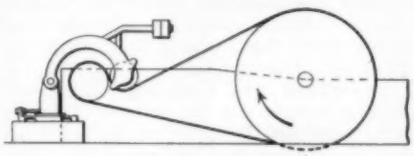
By Viggo Schmel
F. L. Smidth & Co., New York City

The "Lenix" drive, shown in the accompanying diagram, was introduced some years ago by F. L. Smidth & Co., to fill the need for a short-centered belt drive, one not taking up so much space as the usual long-centered drive. In this drive the driving and driven pulleys are placed close together. A free pulley is hinged adjacent to the smaller pulley and bears on the slack side of the belt so that it wraps the belt around the smaller pulley. The belt is of such length that the loose side is within a few inches of the tight side and the initial tension in the belt is due solely to the weight of the hinged floating pulley. The most important feature of the drive is the large arc of contact of the belt with both pulleys, resulting in increased grip of the belt on the pulleys for given initial tension and belt size. When the load is applied, the belt stretches, but instead of becoming looser, the tension in the slack side is maintained constant by the free pulley, and the additional length is automatically wrapped around the small pulley, increasing the arc of contact.

The fundamental formula for belts is $\frac{T_2}{T_1} = e^{f\alpha}$, where T_2 is the tension of the tight side of the belt, T_1 is the tension of the slack side, e the number 2.72, f the co-efficient of friction between the belt and the pulley, and α the angle of contact of the belt with the pulley. To increase the capacity of the drive, allowing a given per cent of slip, it is necessary to increase the width of the belt, to increase the initial tension, to increase the coefficient of friction f by using sticky belt dressing, wood, canvas or paper pulleys, or to increase the arc of contact α. High initial tension is, of course, bad for belt and bearings; sticky belt dressings injure the belt, and the correct crown is eventually worn off wood or paper pulleys. The arc of contact of the belt with the smaller pulley in a certain open drive was 164 deg. On installing the short center drive this was increased to 235 deg. at no load and 251 deg. at full load.

At the New York Power Show, in December, 1924, we exhibited a device for demonstrating visually the relative slip of different types of belt drives and also for comparing the speeds of rotating and reciprocating parts. In this apparatus, a motor-driven line shaft carries three small pulleys of equal diameter, which are connected respectively by belts to three large pulleys, also of equal diameter. One of the pulleys, which will be called the timing pulley, runs free, while the two other pulleys are fitted with prony brakes. One of the brake pulleys is belt driven by the short center drive and the other by an ordinary long center drive. The frames carrying the large pulleys are balanced upon pivots and counterweighted, so that equal bearing pressures can be produced on each pulley bearing and approximately equal initial tensions in each belt.

Upon the web of each of the large pulleys is marked a white cross. The three crosses are illuminated by a flicker lamp synchronized with each quarter revolution of the timing pulley. If the two pulleys carrying prony brakes are running at the same speed as the free pulley, the crosses upon each of them



Outline of "Lenix" Short Center Belt Drive

will always be illuminated when in the same position and will appear to be standing still, but if the two brake pulleys are going, say, 1 per cent slower than the timing pulley, each cross will then be 0.01 of the circumference of the circle behind the position occupied at the time of the previous illumination, and will appear to the eye to be rotating backward. This phenomenon is frequently noticed in moving pictures, where we have all seen a locomotive, for example, pulling into the station with the wheels spinning backward.

The actual slip may be computed by comparing the time of one backward revolution of the observed image of the cross with the speed of the pulley. The slip in per cent is then 100 times the number of revolutions made by the cross in a minute divided by the number of revolutions made by the timing pulley in a minute. As the lag behind the timing pulley is cumulative, the magnitude of the slip may be determined with almost any degree of accuracy required.

When this test was first proposed and the apparatus set up in the plant of F. L. Smidth & Co., the delicacy of this method was not appreciated and only ordinary care was given to obtaining equal pulley ratios. The pulleys were first made with crowns in the usual way, but it was found that the belts would work to the side of the pulleys and thus change the effective diameter of the pulley and consequently the pulley ratio. Accuracy in ratio of the pulleys was obtained by turning all at one operation and without crowns. Although the results were improved, it was still impossible to make all three crosses remain stationary at no load, until it was suggested that possibly the belts were not of equal thickness, and belts made from tracing paper and of uniform weight were substituted. A neavy load could not, of course, be carried, but the results were at least consistent. By careful selection of leather and by buffing the belts to uniform thickness, the desired results were, however, finally obtained with leather belts. It was also noticed that belts did not give the same results when turned hair side as when turned flesh side to the pulley, but that the neutral axis of the belt (and therefore the mean effective diameter of the pulley) is closer to the hair side than to the flesh side of the belt.

Starting with equal pulley ratios and equal belt thickness, at no load both the short center driven and the long center driven crosses will stand still. On applying a light load, both crosses will start to rotate slowly backward, the cross on the long center drive pulley rotating a little faster than the cross on the short center drive pulley. However, as the load increases, without changing the belt tension, the cross on the long center drive pulley will rotate backward at an increasing rate, while the cross on the short center drive pulley will rotate about as before. By the time the slip on the open drive has reached 3 or 4 per cent, the slip on the short center drive will still be within 1 to 2 per cent. If the load is still further increased, the open drive belt will jump off at a load where the short center drive still has a large reserve capacity.

Electric Furnace Electrodes

The General Electric Co., Schenectady, N. Y., has placed on the market a new line of automatic electrode controls for electric arc furnaces that, it is claimed, give closer and more flexible control together with simpler operation from the standpoint of the furnace operator. This control is for use with furnaces for making calcium carbide, abrasives, alloys and similar products.

The line includes three types of regulators for use with one-, two- and three-electrode equipments and for which an auxiliary control panel is required. A special single-electrode panel is also included in this line, combining the main and auxiliary control panel. One of the advantages claimed is a decrease of the time interval between any change in current and the functioning of the equipment to overcome the change, in order to maintain a constant current. This is accomplished by the use of new punched frame contactors, inherently quick act-

ing. The dynamic braking circuit is also completed in a shorter interval of time after power is removed from the motor, thus decreasing to a minimum any over-travel of the electrode. Another advantage is the elimination of bearings or parts subject to wear.

A new voltage relay has been used to prevent the lowering of the electrode into the furnace bath in case of power failure or unbalanced conditions in the furnace. This relay permits a very low calibrating value, allowing the arc voltage to decrease to about 25 volts before opening the control circuit to the lowering contactor. The under-voltage relays are connected across the arc, and open the control circuit only to the lowering contactor controlling that electrode.

A special feature of the auxiliary control is the provision for individual control of each electrode independent of the others. This is possible by the use of a push-button station with transfer switch for each electrode, eliminating the possibility of an operator's trying to lower an electrode while an ammeter is operating to raise it.

Classifying Equipment for Grinding Mills

To do away with the necessity for auxiliary classifying and separating equipment in connection with grinding and pulverizing mills, the Hardinge Co., York, Pa., has equipment that can be installed as part of its standard mills. This equipment, of which there are two types, a rotary and a rotary and superfine classifier, operates on the principle of reversed air currents.

Fig. 1 shows the layout, with the classifier attached at the outlet end of the mill. The same volume of air is used throughout the entire process, separation being secured by regulation of velocity in the different sections of the classifier. The current first enters the mill, stirs up the material, hastening its discharge and at the same time reducing any moisture content. As the material discharges into the classifier, the same current carries the fines directly to the finished product bin and, returning at a greater velocity, blows the over-size material back into the grinding zone, whereupon the cycle recommences. The prompt removal of fines results in an immediate increase of mill capacity and a reduction in the power requirement per unit of material ground.

A fineness of 98 per cent passing 48 mesh or 80 per cent passing 200 mesh can be secured by the rotary classifier. Where a finer product is required, the rotary and superfine classifier can be used, as in this combination equipment there is double classification, making it possible to meet a more rigid fineness requirement.

Fig. 2 shows the mill and classifier as operated on sulphur at the York Chemical Works. It is said that, in a case like this, where explosive material is ground, the classifier lowers the hazard. The air current keeps the material cool and lessens the dangers from such explosions as may occur.

Capacities are from 400 lb. to 35 tons per hour for the rotary classifier and from 300 lb. to 23 tons per hour for the rotary and superfine classifier. The equipment is especially recommended by the makers for use with materials that grind readily but do not discharge easily due to the fluffy nature of the product, such as asbestos.

Induction Furnace

In his article on "High-Frequency Inductive Heating," published in *Chem. & Met.*, Feb. 2, 1925, page 212, Dudley Willcox told of the new developments in inductive furnaces made by the Ajax Electrothermic Corporation, Trenton, N. J. Since that time he has sent the following addition to his article:

"The accompanying table is interesting as furnishing comparisons of the efficiency of the furnace in melting different materials and different forms of material. In the first four cases the material was charged in the form of scrap pressed into 'cabbages' and some loose scrap. The fifth melt recorded consisted only of copper strips. The sixth melt was of a solid lump of nickel-silver that had been allowed to freeze in the crucible over night. It will be noted that the efficiency in this last case was somewhat better than when cabbaged nickel-silver was melted as recorded in the first line of the table. It is of value to know that a molten mass may solidify in the crucible and be remelted without cracking or injuring the crucible."

			Average Readings					
Crucible	Metal	Lb.	Kw. Rate	Time of Hr.	Melting Min.	Total Kw.-Hr. Consumed	Lb. per Kw.-Hr.	Remarks
Cold	Nickel-silver	636	90.1	1	49	163.8	3.98	
Hot	Nickel-silver	636	92.8	1	18.6	121.8	5.23	
Cold	Common brass	636	99	1	04	105.5	6.02	
Hot	Common brass	636	99.5		43	71.3	8.9	
Hot	Copper	636	100	1	09	115	5.53	
Cold	Nickel-silver	600	84.9	1	22	115.70	5.19	Metal in solid lump at start.

(Data on last line taken by E. F. Northrup)

Manufacturers' Latest Publications

Worthington Pump & Machinery Corporation, 115 Broadway, New York, N. Y.—Bullein W-607. A new bulletin entitled "Worthington Centrifugal Pumps Serving Every Industry."

Graver Corporation, East Chicago, Ind.—Bulletin 501. A bulletin describing horizontal and vertical water filters of the pressure type.

Electric Machinery Mfg. Co., Minneapolis, Minn.—Bulletin 861. A description of self-starting synchronous motors for driving various types of pumps.

Esterline-Angus Co., Indianapolis, Ind.—Bulletin 1124. A bulletin on the manufacture of graphic recording instruments.

General Electric Co., Schenectady, N. Y.—No. Y-2041. A booklet describing the voltage drop control system, a contactor control for use with d.c. motors subject to frequent and severe starting duty.

Crescent Refractories Co., Curwensville, Pa.—Series 1, No. 9. A data sheet on heat values and air requirements of fuels.

Conveyors Corporation of America, Chicago, Ill.—A folder describing a flat type ash gate operated by a rack and pinion.

R. P. Cargille, 74 Cortland St., New York, N. Y.—Preliminary announcement of the "R.P.C." viscosity tube, a device for comparing the viscosity of liquids with a standard.

Steere Engineering Co., Detroit, Mich.—Pamphlet 274. A leaflet on the subject of welded steel products.

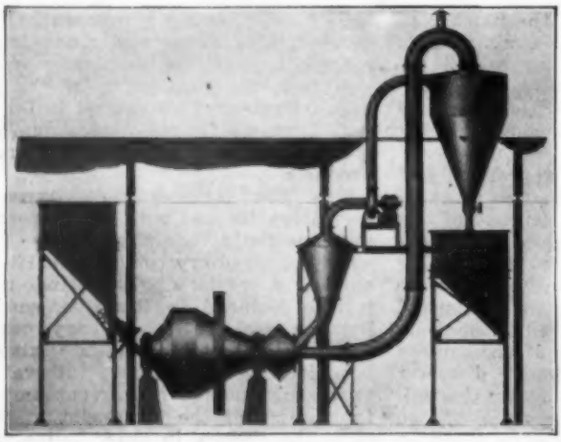


Fig. 1—Layout of Pebble Mill and Rotary and Superfine Classifier and Separator for Continuously Pulverizing Material

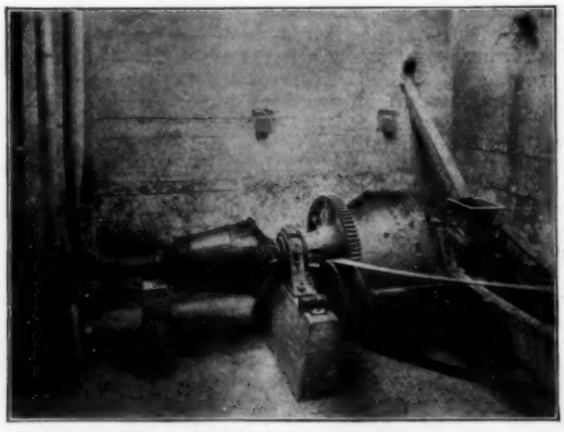


Fig. 2—View of Rotary Classifier Installed in Connection With Pebble Mill in a Chemical Plant for Grinding Sulphur

U. S. Patents Issued Feb. 10, 1925

Straining and Washing Apparatus. John Johnson, Brooklyn, N. Y.—1,525,449.

Method of and Means for Measuring the Flow of Fluid. Horace N. Packard, Milwaukee, Wis., assignor to the Cutler-Hammer Mfg. Co., Milwaukee, Wis.—1,525,463.

Machine for Forming Articles From Semi-Liquid Fibrous Pulp Material. George E. Shaw, Chicago, Ill.—1,525,468.

Manufacture of Arsenic Acid. Ernest W. Wescott, Niagara Falls, N. Y., assignor, by mesne assignments, to Metallurgical Development Corp., Boston, Mass.—1,525,480.

Method of and Means for Drying Paper. Ambrose H. White, Brooklyn, N. Y., assignor to International Paper Co. — 1,525,483.

Method and Apparatus for Testing the Permeability of Fibrous Material. Frederick T. Carson, Washington, D. C.—1,525,495.

Method of Making Chromium-Containing Alloys. William H. Smith, Cleveland, and Charles M. Campbell, East Cleveland, Ohio, assignors to Pioneer Alloy Products Co., Cleveland, Ohio.—1,525,518.

Mold for Chromium Alloys. William H. Smith, Cleveland, and Charles M. Campbell, East Cleveland, Ohio, assignors to Pioneer Alloy Products Co., Cleveland, Ohio. — 1,525,519.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Process for Making Bituminous Paving Mixtures. Thomas J. Barrett, Bordentown, N. J.—1,525,564.

Liquid Fuel. Peter Friesenhahn, Berlin-Halensee, Germany.—1,525,578.

Slitting Machine. Joseph E. Perrault, Watertown, Mass., assignor to Hood Rubber Co., Watertown, Mass.—1,525,590.

Composition of Matter and Process for Preparing Metal for Painting. James H. Gravell, Elkins Park, Pa.—1,525,606.

Polishing Composition and Method of Making the Same. Marie Eliesabeth Mittag, Brooklyn, N. Y.—1,525,654.

Synthetic Refractory Material. James F. Mollen, Cleveland, and Walter W. Patnoe, Tiffin, Ohio, assignors to the Dolomite Products Co., Cleveland, Ohio.—1,525,655.

Carbonating Apparatus. Richard J. Thomas, Milwaukee, Wis.—1,525,674.

Drying Apparatus. Godfrey Engel, Jr., Brooklyn, N. Y., assignor to McGann Mfg. Co., Inc., York, Pa.—1,525,681.

Furnace Construction and Operation. Philip D'H. Dressler, Zanesville, Ohio, assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y.—1,525,725.

Decolorizing Process and Composition Used Therein. Neil S. Kocher, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.—1,525,750.

Process of Treating Cellulosic Films. Henry E. Van Derhoef and Jackson B. Wells, Rochester, N. Y., assignors to Eastman Kodak Co., Rochester, N. Y. — 1,525,761.

Float System for High-Pressure Stills. Frank E. Wellman, Kansas City, Kan., assignor to the Kansas City Gasoline Co., Kansas City, Kan.—1,525,762.

Process of Preparing Highly Active Charcoal. Otto Ernst and Otto Nicodemus, Hochst-on-the-Main, Germany, assignors to Farbwerke vorm. Meister Lucius & Bruning, Hochst-on-the-Main, Germany.—1,525,770.

Grinding Mill. Joseph S. Bartley, Denver, Colo.—1,525,789 and 1,525,790.

Recovery of Calcium Oxalate From the Bark of Trees. William Adolf Fraymouth, Bhopal, India, assignor to the Bhopal Produce Trust, Ltd., Bhopal, Central India. —1,525,806.

Process of Centrifugally Separating Ingredients One of Which Is Resistant to Flow and Centrifugal Bowl for Carrying Out Said Process. Selden H. Hall, Poughkeepsie, N. Y., assignor to the DeLaval Separator Co., New York, N. Y.—1,525,808.

Protecting Coating and Process for Producing Same. William H. Allen, Detroit, Mich.—1,525,904.

Art of Converting Oils. Edgar M. Clark, New York, N. Y., assignor to Standard Development Co.—1,525,916.

Apparatus for Distilling Hydrocarbon Oils. Max G. Paulus, Whiting, Ind., assignor to Standard Oil Co., Whiting, Ind., and Chicago, Ill.—1,526,010.

Narcotic. Herman Wieland Konigsberg, Germany, assignor to the Firm of C. R. Roehringer Sohn, Chemische Fabrik, Nieder-Ingelheim-on-the-Rhine, Germany.—1,526,034.

Chewing Gum and Method of Making the Same. William C. Arkell and Marion G. Mastin, Canajoharie, N. Y.—1,526,039.

Arsenical Preparation and Method of Producing the Same. Otto Lowy, Newark, N. J., assignor, by mesne assignments, to Technical Products Corp.—1,526,072.

Pulverizer. Joseph Molz, Oberhausen, Germany, assignor to the Babcock & Wilcox Co., Bayonne, N. J.—1,526,077.

Coating Aluminum Articles. Fulton B. Flick, New Kensington, Pa., assignor to Aluminum Co. of America, Pittsburgh, Pa. —1,526,127.

Dyeing Cellulose Esters. Fritz Gunther, Ludwigshafen-on-the-Rhine, Germany, assignor to the Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,526,142.

Gas-Treating Apparatus. Lowell H. Milligan, Worcester, Mass.—1,526,170.

Process for the Recovery of Fixed Nitrogen When Using or Treating Combustibles. Walter Ostwald, Tanndorf-on-the-Mulde, Germany.—1,526,178.

Method of Aërating or Agitating Liquids. Geoffrey Warner Parr, London, and Robert Croucher, Bromley, England.—1,526,179.

Fourdrinier Machine. Walther Voith, St. Poelten, Austria, assignor to American Voith Contact Co., Inc., New York, N. Y.—1,526,193.

Clarification Process and Apparatus. Harald Ahlqvist, New York, N. Y. — 1,526,197.

Apparatus for Cleaning Gas and Vapors, More Especially Blast-Furnace Gases. Hermann Henrich, Duisburg, Germany, assignor to Deutsche Maschinenfabrik A. G., Duisburg, Germany.—1,526,280.

Process of Making Rubberized Fiber Composition. Robley H. Morrison, Akron, Ohio, assignor to the Goodyear Tire & Rubber Co., Akron, Ohio. — 1,526,297 and 1,526,298.

Method of Manufacturing Rubberized Fiber Composition. William O'Brien, Akron, Ohio, assignor to the Goodyear Tire & Rubber Co., Akron, Ohio.—1,526,299.

Method of Vulcanizing Caoutchouc and Products Obtained Thereby. Lorin B. Sebrell, Akron, Ohio, assignor to the Goodyear Tire & Rubber Co., Akron, Ohio.—1,526,300.

Industrial Notes

Edward T. Moore announces the opening of his office at 500 Cahill Bldg., Syracuse, N. Y., for the general practice of consulting engineering and the manufacture of the "Moore Electric Power Regulator." Mr. Moore will specialize in industrial plant problems and electric furnace installations with which the Moore electric power regulator is closely allied.

The Queen City Steel Treating Co. and the Metallurgical Service Co., both of Cincinnati, combined their businesses on the first of the year, and are now operating under the name of the first concern. E. P. Stenger, metallurgical engineer and president and manager of the Queen City Steel Treating Co., is the active head of the corporation, and N. M. Salkover, who formerly conducted the Metallurgical Service Co. and who is also a graduate metallurgical engineer, is a member of the Queen City organization. In addition to operating a modern commercial heat-treating plant, the company now sells heat-treating equipment and supplies. It is the Cincinnati district representative for the American Gas Furnace Co., the Case Hardening Service Co., Charles Engelhard, Inc., the General Alloys Co. and other well-known concerns in this field.

The Republic Carbon Co. was organized by the Uihlein interests of Milwaukee in 1920 for the manufacture of carbon electrodes and a modern electrode plant was built at Niagara Falls, N. Y. This plant has been in operation for the past 4 years supplying high-grade electrodes to electric steel foundries, ferro-alloy manufacturers and to the general electric furnace industry. The Aluminum Co. of America, the Carborundum Co. and associated interests have recently acquired a part interest in the Republic Carbon Co. and have taken over the management. Plans have been made to extend the plant and enlarge the scope of its operations. The Uihlein interests still retain large stock interests in the company. The officers of the company are as follows: F. J. Tone, president; I. W. Wilson, vice-president; F. H. Manley, treasurer. The general offices, including the sales department, of which R. L. Baldwin is sales manager, have been moved to Niagara Falls, N. Y.

G. H. Williams Co., manufacturer of clamshell buckets for rehandling, excavating and dredging, at Erie, Pa., announces that R. B. Randall, who for approximately 6 years was Western sales manager of Blaw-Knox Co., has been appointed Western sales manager of the Williams Co., with headquarters in Chicago.

At the annual meeting of the directors of Gardiner & Lewis, Inc., engineer and manufacturer specializing in protection against water and corrosion, held at the office of the company, 30 Church St., New York, Jan. 20, the following officers were elected for the ensuing year: President, Richard W. Lewis; vice-president, Russel B. Reid; treasurer, Richard W. Lewis, and secretary, Jacob W. Winkler.

A reorganization has been effected in the Anderson Chemical Co. of Passaic, N. J., resulting from the purchase of this company by the Merrimac Chemical Co. of 148 State St., Boston, Mass. The former personnel of the Anderson Chemical Co. has been retained and the resources of the Merrimac Chemical Co. have been made available to it. The policy of the new organization will be to continue producing the same high-grade products that have been produced heretofore, including split leather dopes, lacquers, lacquer enamels, solvents, belt cements, thinners, and nitro-cotton solutions. The new officers of the company are: Charles Belknap, president; H. O. Lichtenwalter, vice-president and general manager; W. I. Warren, assistant treasurer, and Miss Josephine Eberhard, secretary. The directors include: George H. Clough, president of the Russel Co.; Salmon P. Wilder, president, Merrimac Chemical Co.; Charles Belknap, vice-president, Merrimac Chemical Co.; Andrew F. Carter, vice-president, Russel Co., and H. O. Lichtenwalter, assistant to vice-president, Merrimac Chemical Co.

News of the Industry

Summary of the Week

The coming report of investigation into linseed oil is expected to indicate that a lower duty is justified to equalize costs of production.

Bill will be introduced in Senate to create revolving fund for government purchases of nitrate of soda.

Italian textile manufacturers favor arrangements for a continuance of deliveries of reparation dyes.

New method of producing methanol in Germany affects American industry and raises question of increasing import duty.

Chandler medal is bestowed upon Dr. E. C. Kendall at Columbia University.

Bill to give chief of Chemical Warfare Service rank of Major-General passes both houses of Congress.

Italian Textile Interests Want Reparation Dyes Continued

The Italian textile industries have manifested some alarm for fear that the commercial treaty that will be drawn up between Italy and Germany in March at the expiration of the temporary agreement now in effect will alter the obligation of Germany to furnish Italy with dyes up to 1928, as arranged by the Dawes plan, instead of deliveries on account of reparations ceasing early this year as provided by the treaty of Versailles, say advices to the Department of Commerce from Rome. This pre-occupation has influenced many textile mills to lay in supplies of dyestuffs, with a resulting rise in price. It is likely that, unless considerable amounts continue to be received from Germany on account of reparations, the demand for imported dyestuffs on the part of the textile industries will be intensified.

To Revive Plan for Government Purchases of Chilean Nitrate

Inspired by a letter from the president of the American Cotton Association alleging that fertilizer companies have increased the price of their product in the South Atlantic states, that there is no competition and that some of the fertilizer contains inferior ingredients, Senator Smith of South Carolina told the Senate, Feb. 17, that he proposes to reintroduce his bill to create a revolving fund and have the government purchase nitrate in Chile and sell it to farmers at cost plus handling charges.

The increase in price, Senator Smith said, has been $6 per ton in South Carolina at least, which he said would mean an added burden of $6,000,000 to the farmers of that state this year as compared with last year. Senator Smith further urged that there be a reduction of freight rates on commercial fertilizer to take care of the mixer used with the chemicals. A product which is nine-tenths earth should not be compelled to pay a freight rate as a chemical product, he said.

The letter from the American Cotton Association was read into the record by Senator Smith. In it complaint is made regarding the chemical ingredients of some fertilizers on the market.

Plans to Improve Statistics on Synthetic Chemicals

The Chemical Division of the Department of Commerce is considering the extension of its monthly dye list to include synthetic chemicals of non-coal-tar origin. Many difficulties stand in the way of this improvement in the service and no assurance can be given at this time that the proposal can be worked out. It is the feeling of C. C. Concannon, chief of the Chemical Division, that the department can serve the chemical industry in no more effective way than by improving chemical statistics. A major effort to that end is being undertaken.

Subscriptions to *Chem. & Met.* Will Be Extended

As announced on the first editorial page of this issue, *Chem. & Met.* will hereafter be published as a monthly magazine on the 15th of each month. Subscribers who have paid for the weekly at the rate of $4 a year will have their subscriptions automatically extended. The new rate for the monthly is $3 a year. The unearned part of money already paid on unexpired subscriptions will be applied at the new rate. Thus if a subscription still has 6 months to run, it will be extended to 8 months; if one year, to 16 months, and proportionately for other periods.

Congress Passes Bill to Make Fries a Major-General

A bill providing that the Chief of the Chemical Warfare Service and the Chief of Finance of the War Department shall have the rank, pay and allowances of a Major-General was passed by the House on Feb. 16 by a vote of 91 to 4. The bill was also passed by the Senate on Feb. 18. It will have the effect of raising these two officials from their present rank of Brigadier-General.

The measure was advocated before the House Military affairs Committee by several chemists and others interested in the Chemical Warfare Service, on the ground that the chief of that branch of the army, Brigadier-General Amos A. Fries, was entitled to the same rank, that of Major-General, which is accorded other officers who serve as heads of distinct branches of the army.

The bill now goes to the President for his signature and the chemical industry confidently expects his approval.

British and French Dye Firms Form Working Agreement

Reports that a merger has been effective between the British Alizarine Co., Ltd., and the Etablissements Kuhlmann of Paris apparently are not well founded, but significant agreements between the two concerns have been made. The Kuhlmann company is understood to have committed itself to buy all of its intermediates used in the manufacture of aniline dyes from the British company. The British company has made such inroads into the French market that the French regard it as good business to reach an agreement whereby one-third of the French market was allocated to the British company, with the French company agreeing to buy such dyes as it does not manufacture, rather than to purchase them from German competitors.

Providence Exposition Announces Progress

The equipment exposition of the Chemical Equipment Association to be held in Providence June 22 to 27, 1925, at the same time as the meeting of the American Institute of Chemical Engineers, promises to be successful. Interest is being developed in the show by means of a miniature newspaper called the *Flow Sheet*. This is being mailed to technical men and industrial executives, especially in New England, where the campaign has been an intensive one. Replies have been numerous and interested, and it is predicted that the guaranteed attendance of a thousand will be greatly exceeded.

The simultaneous meeting of the American Institute of Chemical Engineers and of two other technical societies will add greatly to the interest of the occasion and it is significant that the Institute will devote one full day to an inspection of the show.

At the request of the Institute another day will be devoted to papers dealing with the engineering phases of equipment.

Those desiring further information or wishing to have the *Flow Sheet* mailed to them should communicate with Roberts Everett, 1328 Broadway, New York City.

Practical Process for Raisin Sirup Perfected

As a result of research and investigation extending over a period of about a year, the Sun-Maid Raisin Growers Association, Fresno, Calif., Ralph P. Merritt, president, has perfected what is regarded as a revolutionary and vital development in the raisin industry—namely, a practical process for raisin sirup manufacture. The technical work has been under the direction of F. M. deBeers, formerly of the Swenson Evaporator Co., assisted by Dr. J. K. Dale, in charge of the research laboratory, and H. W. Denny, research technologist. The Miner Laboratories of Chicago and the Twining Laboratories of Fresno assisted in the work as consultants. Development work for the first 9 months has resulted in the production of a satisfactory sirup with such byproducts as cream-of-tartar, stock feed and press cake fertilizer. The development will be commercialized through a subsidiary company, which will construct a new factory, storage buildings, power plant, office and laboratory.

Washington Section, A.C.S., Announces Prize for Best Paper

As a recognition of the most meritorious paper presented during the calendar year before the Washington Section of the American Chemical Society, there is to be awarded a suitably bound and inscribed set of the "International Critical Tables of Physical and Chemical Constants." This plan has been made possible by members of the Washington Section, who desire to encourage the preparation of the very best available papers for the meetings of the society.

Baltimore Meeting, A.C.S.

Plans Rapidly Crystallizing for Sixty-Ninth Session—Symposium on Corrosion

Plans are going forward rapidly for the sixty-ninth meeting of the American Chemical Society, to be held in Baltimore April 6 to 10. The registration bureau will open at 10 a.m. on Monday, April 6, in the Emerson Hotel. The Council meeting will be held during the afternoon and evening of Monday, and on Tuesday at 11:30 a.m. the general meeting will take place. Albert C. Ritchie, Governor of Maryland, and Howard W. Jackson, Mayor of Baltimore, will welcome the members of the society, and responses will be made by Dr. James F. Norris, president of the society, and Dr. Neil E. Gordon, chairman of the Maryland Section.

During the week divisional and sectional meetings will be held at the Emerson Hotel, Southern Hotel, Engineers Club and Johns Hopkins University.

The rules of the society provide that all papers must be in the hands of the secretary of the appropriate division or section not later than March 7. Accordingly it will be some time after that date that the final program of papers can be announced. However, it is certain that in the Division of Industrial and Engineering Chemistry there will be papers on "The Future of Industrial Synthetic Organic Chemicals in the United States," by Charles H. Herty; "Chemistry and the Leather Industry," by Allen Rogers, and "A Quarter of a Century of Chemistry in Rubber," by W. C. Geer.

In the Division of Industrial Chemistry there will be a symposium on corrosion, beginning on Wednesday morning, in which the Petroleum Division will join. Contributors to this symposium will include W. R. Whitney, W. D. Bancroft, W. H. Bassett, Guy D. Bengough and Ulick R. Evans.

The Gas and Fuel Section will hold a symposium on flames. The discussion will include the phenomena of propagation of flames in a closed vessel, flames for industrial gas burners, control of flames, and some of the fundamental theory. A summary of the research on flames by Payman and his English co-workers is also included in the program.

The reactions involved in combustion in producer-gas generation and the mechanism of steam-carbon reactions in water-gas making will be covered by two papers already promised for the program. Carbonization of Ohio coal, investigation of phenols in low-temperature tar, and a summary of fuel research in Europe are other papers promised. It is hoped Dr. Franz Fischer, the eminent German fuel investigator, will be present and deliver one or more papers on his recent research.

Several diversions from reading and discussion of papers are promised. On Wednesday a visit is planned to the Naval Academy at Annapolis and on Thursday a military demonstration will be staged at the Aberdeen Proving Grounds.

Dr. Edward Calvin Kendall Receives the Chandler Medal

The Chandler medal for distinguished achievement in science was on Feb. 13 bestowed upon Dr. Edward Calvin Kendall, head of the chemical section of the Mayo Foundation for Medical Education and Research, University of Minnesota, at Havemeyer Hall, Columbia University, in the presence of leading chemists and educators from universities and laboratories in the East and Middle West.

Dr. Kendall, as Chandler lecturer for 1925, delivered an address on "The Influence of the Thyroid Gland on Oxidation in the Animal Organism." The medal and lecture are provided annually by the Chandler Foundation, established in 1910 by friends of Dr. Charles Frederick Chandler, Mitchill professor emeritus of chemistry in Columbia and known as the dean of American chemists.

Dr. Kendall, a graduate of the Columbia Schools of Mines, Engineering and Chemistry in 1908, and a recipient of a Ph.D. degree from the university in 1910, is the first Columbia man as well as the youngest scientist to be honored by the Foundation.

The medal was presented by Dr. Chandler, now in his ninetieth year. Dean George B. Pegram of the Columbia Schools of Mines, Engineering and Chemistry presided. Dr. Ralph H. McKee, professor of chemical engineering, was chairman of the committee in charge of arrangements, the other members being Dr. Daniel D. Jackson, professor of chemical engineering, and Dr. H. C. Sherman, present Mitchill professor of chemistry.

Others who have received the Chandler medal include Dr. L. H. Baekeland of New York, past president of the American Chemical Society; Dr. W. F. Hillebrand, U. S. Bureau of Standards; Dr. W. R. Whitney, Schenectady, N. Y.; Dr. F. Gowland Hopkins, and Dr. Edgar F. Smith, provost emeritus of the University of Pennsylvania.

Summer Course at Cornell in Chemical Microscopy

In addition to the courses regularly given, the department of chemistry of Cornell University this year is offering courses in chemical microscopy as a part of the curriculum of the summer session. A general course in the applications of the microscope to chemistry, and another covering the field of microscopic inorganic qualitative analysis, both of which will be the full equivalent of those given in the regular college year, are to be scheduled. These may be taken separately or together, or in conjunction with other courses in the summer session. Chemists not desiring university credit may arrange to cover only such portions of the work as are most suited to their needs, and thus obtain the essential training in a minimum period of time.

Dr. C. W. Mason, who has handled the regular courses during the absence of Prof. E. M. Chamot, will have charge of the work in the summer session.

Washington News

Tariff Commission Ready to Report on Linseed Oil

Recommendation for Reduction in Duty Regarded as Probable

Indications are that the Tariff Commission within the next few days will send to the President a report on its investigations of costs of producing linseed oil under the terms of the flexible tariff. There is a possibility that the report will be in two sections, indicating to the President different degrees of reduction. The Commissioners are understood to be in disagreement only as to the period in which cost figures should be taken into consideration, but this difference would affect the cost figures.

The present duty on linseed oil is 3.3 cents per pound, which is equivalent to approximately 23 cents per gallon. The investigations of the commission are understood to indicate that a duty of 18 to 21 cents per gallon, according to the period of time considered, would be sufficient to equalize cost of production. These figures, however, are entirely unofficial. The duty on linseed oil in the Underwood tariff bill was 10 cents per gallon. No change was made in this rate in the emergency tariff of 1921, and one of the chief complaints that was made against that temporary act was that the duty on flaxseed was increased without a corresponding change in the linseed oil rate.

Farm Organizations Oppose

If the President were to reduce the duty on linseed oil, it is a foregone conclusion that the farm organizations, which already are bitterly opposed to the flexible tariff, would increase their opposition. In the face of the recommendations of the President's Conference on Agriculture, which include one for adequate protection in the tariff for farm products, it is believed that the President would proceed slowly in making any reduction on any commodity affecting an agricultural product, unless there were a strong showing of the necessity of a reduction.

A storm regarding the entire flexible tariff experiment is ready to burst whenever Congress takes up tariff revision, which from present indications will be forced upon the legislators next winter, because of pressure for adjustment of the agricultural schedule. Representative William R. Green, chairman of the Ways and Means Committee, has publicly announced his position as favoring repeal of the flexible tariff, and in this attitude he has been joined by a number of other Republicans and practically all of the Democrats who are members of that committee. On the other hand, President Coolidge and Secretary of Commerce Hoover have publicly urged retention of the flexible provisions in order to facilitate adjustments of the tariff to meet changing conditions and as a step toward scientific tariff making.

Dyes Constitute Minor Cost of Finished Leather

Dyes constitute a negligible part of the cost of finished leather. This is shown conclusively in a report just made to the Senate in response to Resolution 256 adopted at the last session. The cost of the dye per square foot of finished leather was found to vary from one-tenth of a cent per square foot to four-tenths of a cent per square foot, according to the shade. One of the tables of cost submitted with the report, covering a light shade, shows that for each 1,000 sq.ft. of leather these costs are as follows: Sumac extract, 39 cents; cutch extract, 10½ cents; dye, $1.02; tartar emetic, 8 cents, a total of $2.35½.

The investigation showed that practically all tanned calfskins are dyed and that coal-tar dyes are used almost exclusively. The total amount of dyes used by the industry is small, however, constituting less than three-fifths of one per cent of the total production of coal-tar dyes in the United States. While fourteen dyes constitute 90 per cent of the total quantity used by the calf tanners, six of the fourteen dyes account for seven-eighths of the tanners' requirements. They are Bismark brown, direct deep black EW, nigrosine WS, phosphine, resorcine brown, and orange II. It was found that the American prices of the fourteen dyes are comparable with those prevailing in competing countries in Europe. In most instances, American tanners are paying a lower price for the six major dyes than are their competitors in Europe.

Italian Caustic Soda Output Not Sufficient for Home Needs

Production of caustic soda in Italy by the diaphragm process or by the Solvay-Kellner mercury process is not on the increase, according to E. Humes, clerk to the American Commercial Attaché in Rome. This condition of the industry is attributed to the difficulty in securing a satisfactory market for the principal byproduct, chlorine. Production figures of caustic soda and chlorine are available up to 1922 only and are given below:

	1919 Tons	1920 Tons	1921 Tons	1922 Tons
Caustic soda (solid)	5,077	5,600	4,560	5,235
Caustic soda (liquid)	13,226	20,790	21,440	31,970
Chlorine	427	560	530	543

Present production of caustic soda is said to range around 83 tons daily and of chlorine around 68 tons daily. Five large Italian plants and numerous smaller ones are engaged in the manufacture of caustic soda. The demand for chlorine in the form of calcium hypochlorite is increasing both at home and abroad. In 1922 Italy imported 846 tons of hypochlorite, 1,318 tons in 1923 and 1,262 tons in the first 10 months of 1924, and exported 2,152 tons. 2,677 tons and 4,172 tons respectively for the same periods.

Italy is favorably situated for increasing her production of caustic soda. The industry has a sufficient salt supply and plenty of cheap hydroelectric power at its disposal to be applied in the electrolytic process. It is hoped that the growing production of potash by the action of chlorine on leucites will open a new outlet for this byproduct of the caustic soda industry, which is at present rather a drug on the market, with a resulting increase in the production of caustic soda itself. At the present time Italy is dependent on foreign sources for approximately half her consumptive needs of caustic soda. The annual requirements of the country are estimated at about 40,000 tons. From 20,000 tons to 25,000 tons are industrially available yearly from the domestic production.

Trade Commission Prompt in Taking Up Power Investigation

The Federal Trade Commission is losing no time in beginning the investigation of the General Electric Co. ordered by the United States Senate. When the resolution was delivered to the commission on Feb. 12, a meeting of the members was called and it was decided to refer the resolution to the commission's economic division, because the work was regarded as likely to be more of a statistical and accounting character rather than of a legal nature. Schedules have been arranged looking to the completion of the investigation in time for the commission to have its report ready by Dec. 1.

Some of those who see in this probe an effort to boost public ownership are hoping that the commission's investigation may go far enough to show who were furnishing the evidence presented to support the resolution. There is a rumor to the effect that a public ownership group had effective co-operation from a competing manufacturing concern.

France Increases Consumption of Superphosphates

According to a recent statement of Mr. Queille, Minister of Agriculture, French agriculturists have increased their sowings of autumn wheat by approximately 200,000 hectares and have utilized for the cultivation of their winter cereals about 300,000 tons of superphosphates in excess of that employed in 1923. Under the encouragement given by the Ministry of Agriculture, orders for scories for December, 1924, and January, 1925, were more than twice as large as those placed during the similar months of 1923 and 1924.

American Exports of Dyes Raise Comments in German Press

Ability of American dye makers to lay down their product in Europe in competition with the German plants has aroused no little comment in the German press. It is explained in part by the "thievery" of the German patents under the treaty of Versailles. Mass production and a concentrated industry are other explanations advanced. Japan is giving the United States a considerable part of its dye orders for "political reasons," one paper says.

Trade Notes

John H. Nelson has resigned as assistant chief of the Far Eastern Division of the Department of Commerce. Mr. Nelson will become manager of Hoyt & Co. of Shanghai.

The Mond Nickel Co. is building a sulphuric acid plant at its smelter at Coniston, Ont., Canada. It is intended to begin production in the latter part of 1925. This is the first step in the utilization of the large quantities of sulphuric gas going to waste in the Sudbury smelters.

Chess Lamberton, J. C. Dick and F. M. McClelland, Franklin, Pa., have acquired the plant, properties and equipment of the defunct Bone Dry Lime Corporation, located at Cassadaga, N. Y., valued at $150,000. It is planned to put the plant in operation.

The branch plant of Courtaulds, Ltd., which is being established at Cornwall, Ont., Canada for the manufacture of artificial silk, will shortly be ready for operation. The buildings have been completed, and the machinery is being installed.

The Virginia Carolina Chemical Co., with the approval of the court, has sold the Prince Adalbert Potash Mines, in Germany, to Herbert M. May, for $2,052,000. It is understood that the buyer represented the Wintershall Konzern, the largest potash operators in Germany.

Material progress has been made in the erection of the new plant of the Dye & Chemical Co. of Canada, Ltd., at Kingston, Ont. F. W. Atack is president of the company.

Painting Specifications Recommended

Plant operators, as well as paint manufacturers and dealers, will find valuable guidance in painting in the Bureau of Standards Technologic Paper 274, entitled "Use of United States Government Specification Paints and Paint Materials," by P. H. Walker and E. F. Hickson. In this publication a brief description is given of the various materials covered by the specifications. It is believed that the existing specifications are sufficient for practically all necessary painting operations of the government. The system of using semi-paste paint, whenever possible, is recommended, and suitable thinning formulas applicable for the average painting condition have been developed. The proper method of breaking up and thinning stiff pastes in oil, semi-pastes and mixed paints is discussed. The practical application of the various paints to all of the ordinary surfaces, such as wood, metal, cement, plaster, concrete, etc., is brought out and recommendations made. The care of brushes and the brushing of paint is described. The numerous specifications referred to in the text are also available to those interested on application at the bureau.

Decline in Exports of Dyes From Germany

The extent to which Germany's exports of dyes has decreased is shown by the 1924 figures. In the latter year the value of the exports of aniline-tar-sulphide dyes was only 37 per cent of the value of those dyes exported in 1913. The value of alizarine dyes made from anthracine was only 5 per cent of the value of the export of those dyes in 1913. In like manner indigo, indigo carmine and varnish colors declined to 8 per cent; zinc oxide, zinc dust and sulphite declined to 48 per cent; zinc lithopone and red lead declined to 60 per cent; red iron ocher, white lead and permanent white to 17 per cent; chalk, iron oxide, umber and Sinnea earth to 80 per cent.

Higher Duty Suggested to Check Imports of Methanol

That Germany's new method of producing methanol from coke is going to affect profoundly the American wood alcohol industry is becoming increasingly apparent. American exports of wood alcohol to Germany have ceased. What is more, our imports of the German product are increasing and since the domestic product can be undersold by a considerable margin, much larger imports are expected. The situation is one which is believed to call for the immediate consideration of the Tariff Commission.

Discussion of the possibility of increasing the tariff on methanol is accompanied by some talk as to the effect of the duty on butyl alcohol. In that connection it is claimed that the rate on this latter commodity is prohibitive and in addition makes it possible for the manufacturers of butyl alcohol to sell acetone at prices which the manufacturers of wood chemicals cannot meet.

Experiments With Novel Type of Fillers for Cements

A London firm of engineers is experimenting with a novel type of filler for cements, particularly those containing alkalis or lime. This filler consists of a fibrous material, such as sawdust, wood pulp, coir, cork or wooden laths, which are impregnated with a basic solution of a metallic salt, and a mineral compound is precipitated in and on the fibers from the solution. For example, an iron salt, such as ferric chloride, is rendered basic by the addition of an alkali or alkaline earth hydrate or salt, the amount added being such that a silght excess would produce a permanent precipitate. Suitable proportions are 1 lb. of iron perchloride in 10 lb. water and about 2 lb. caustic soda. The fibrous material is impregnated by the solution and a precipitate is formed by the addition of an alkali, by heat, or merely by keeping the fiber in the atmosphere. In the case of aluminous cements, such as ciment fondu, lime is usually added to obtain the necessary reaction after the concrete has been mixed.

Financial

The Goodyear Tire & Rubber Co. has declared a regular quarterly dividend of $2 on the prior preference stock. No action was taken on the preferred stock. The board is considering plans for adjusting arrearages on the preferred and hopes to make an announcement this week.

The By-Products Coke Corporation for year ended Dec. 31 reports deficit of $498,222 after interest and depreciation, against net income of $559,373 in 1923. Current assets as of the close of the year totaled $3,809,719 and current liabilities $896,740.

E. I. du Pont de Nemours & Co. have declared a quarterly dividend of $2.50 on the common, putting it on a $10 annual basis. The company had been paying $2 quarterly since Sept. 15, 1923, when the disbursement was raised from $1.50. Regular 1½ per cent on the debenture stock was also declared.

The Eagle-Picher Lead Co. reports for the past year consolidated gross income of $5,949,501. Net profit after expenses, depreciation, depletion and federal taxes was $3,053,095. Total assets were $43,080,192 and profit and loss surplus $9,574,910.

The stockholders of the California Cyanide Co., a subsidiary of the Air Reduction Co., have received notice of a special meeting to be held March 4 to authorize an issue of $1,250,000 5-year 6 per cent convertible gold debenture bonds and with the proceeds to take up the entire floating indebtedness of the company, amounting to approximately $1,100,000 now owing to the Air Reduction Co. and to provide additional funds for working capital.

The report of Air Reduction Co., Inc., for the year ended Dec. 31, shows net profits of $1,635,221 after interest, federal taxes and depreciation reserve, etc., equivalent to $8.56 a share earned, and compares with $2,138,023, or $12.31 a share, earned in 1923.

Use of White Lead Prohibited in Russia

The Commissariat of Labor of the United Socialist Soviet Republics of Russia has issued a special decree whereby it is forbidden to open any new factories for the manufacture of white lead or to import the latter from abroad.

After July 1, 1925, the free sale of dry white lead is prohibited; in the form of paints it may only be sold in the crushed form. Certain enterprises which cannot carry on their work without the use of dry white lead may obtain special permission to use the latter, but only up to Jan. 1, 1930. From Jan. 1, 1926, the use of white lead for internal house decoration or for painting household articles is strictly forbidden.

From Jan. 1, 1930, all production, sale or use of white lead in any form whatsoever is prohibited over the whole of Russia.

Men You Should Know About

J. I. AGNEW, president of the International Nickel Co., New York, gave an address on the nickel industry of Ontario, Canada, at a recent meeting of the Toronto Branch of the Canadian Institute of Mining and Metallurgy.

Dr. ERNEST BAERWIND, of the Metallo Chemical Works, Frankfort, Germany, has arrived in New York on a visit to the United States. ERNST BRANDUS, of the same company, also is here on a business trip.

Prof. WILDER D. BANCROFT, of Cornell, addressed the Society of Chemical Industry, of Montreal, on Feb. 16, on "Bubbles, Drops and Grains."

Dr. DANIEL BASE, chief chemist of Hynson, Wescott & Dunning, of Baltimore, Md., spoke on Feb. 13 before the Maryland Section of the American Chemical Society, on "Therapeutic Application of Some Organic Antimony Compounds."

E. D. BOTTS, until recently assistant professor of chemistry at the University of Louisville, is now research chemist with the American Marine Paint Co., San Francisco.

H. W. CAMP, general superintendent for the Empire Refineries, Inc., Tulsa, Okla., will give an address on the subject "Developments in Design and Operation in Topping Plants" at the forthcoming meeting of the Western Petroleum Refiners Association, Kansas City, Mo., March 3 to 5. Dr. F. W. L. TYDEMAN, of the Roxana Petroleum Corporation, St. Louis, Mo., will give an address at the gathering entitled "Corrosion in a Petroleum Refinery."

F. H. CHERRY, associate professor of electrical engineering at the University of California, addressed a joint meeting of the local sections of the American Society of Mechanical Engineers and the American Electrochemical Society at San Francisco recently, on his interpretation of the electrolytic theory of corrosion. He was followed by Prof. E. D. EASTMAN, who discussed the subject from the chemical viewpoint.

Colonel AUSTEN COLGATE, of Colgate & Co., Jersey City, N. J., manufacturers of soaps, etc., has been elected president of William E. Quimby, Inc., Newark, N. J., manufacturer of pumps, as well as president of the Sundh Electric Co., of the same city.

S. D. COOPER of Topeka, Kan., manager of the wood-treating plants of the Atchison, Topeka & Santa Fe Railway, has been elected president of the American Wood Preservers Association for the ensuing year.

RALPH R. CURRY, heretofore assistant general superintendent at the Portsmouth, Ohio, plant of the Wheeling Steel Corporation, has resigned to become superintendent at the plant of the Allegheny Steel Co., Breckenridge, Pa.

O. H. FAIRCHILD, of Fairchild & Fairchild, Chicago, is in Arkansas City, Kan., for the Universal Oil Products Co., working on the problem of removing the free carbon from the residuum in the cracking process.

KARL GEBHARDT and LEO HORVAT, of the German Vacuum Oil Co., Hamburg, Germany, have arrived in New York on a business trip.

ROBERT M. KEENEY has been transferred from the Westinghouse Electric & Manufacturing Co., Boston, Mass., to the general engineering department at East Pittsburgh, where he will be in the electrochemical and electrometallurgical section.

Dr. M. KHARASCH, professor of organic chemistry at the University of Maryland, spoke before the Maryland Section of the American Chemical Society, on Feb. 13, on "Electronic Conception of Valence and Heats of Combustion."

LESTER A. LENNING has been appointed chief metallurgist at the plant of the New Departure Manufacturing Co., Bristol, Conn., to succeed M. E. GERR, recently resigned.

PAUL G. LEONI, managing director of the Iron & Ore Corporation of America, New York, has returned to the city after a trip abroad.

C. G. MAIER, associate metallurgist of the U. S. Bureau of Mines, Berkeley, Calif., addressed the members of the California Section of the American Chemical Society on Feb. 6 on "The Theory and Technical Application of Auto-Oxidation of Sulphur Dioxide and Ferrous Sulphate Solution by Air."

GEORGE L. MOREHEAD, of the Link-Belt Co., Indianapolis, Ind., has been elected president of the Foundrymen's Association of Indianapolis for the coming year. J. H. HOOKER has been elected treasurer, and A. J. ALLEN, re-elected secretary.

Prof. JAMES F. NORRIS, president of the American Chemical Society, addressed the Washington (D. C.) section of the society on Feb. 12, on the subject "The Reactivity of Atoms and Groups in Organic Compounds."

M. L. OGLESBY, of New York, gave an illustrated lecture under the auspices of the Western Maryland and other railroads, at the City Hall, Cumberland, Md., on Feb. 10, termed "The Careful Handling of Explosives."

HAROLD J. PAYNE, of the editorial staff of *Chem. & Met.*, has joined the staff of the Society for Electrical Development, New York City, where he will be engaged in promotion work with special reference to industrial transportation.

Dr. CHARLES L. REESE, president of the American Institute of Chemical Engineers, delivered an address in Convocation Hall, University of Toronto, on Feb. 16, on "Twenty-five Years Progress in Explosives."

J. S. REICHERT, formerly professor of chemistry at the University of Notre Dame, has been appointed a chemist in the Chemical Warfare Service, Edgewood Arsenal.

Prof. BRADLEY STOUGHTON, department of metallurgy, Lehigh University, Bethlehem, Pa., gave an interesting and instructive address on the subject of "Metallurgy" before the members of the local Rotary Club at the Hotel Bethlehem, on Feb. 11.

DAVID WALLACE, superintendent of the American Dyewood Co., Chester, Pa., gave an address before the members of the Philadelphia Section of the American Association of Textile Chemists and Colorists, Feb. 13, in the auditorium at the Philadelphia Textile School, Philadelphia, Pa., on the subject "Natural Dyes, What They Are and Their Present Day Importance."

CHARLES WADSWORTH, 3D, managing editor of *Chem. & Met.*, has been transferred to the business staff of the paper to take charge of the investigations of the Business Department into the marketing problems of equipment manufacturers.

H. H. WANDERS, market editor of *Chem. & Met.*, has been transferred to the Newspaper Service Bureau of the McGraw-Hill Co.

ALAN G. WIKOFF, assistant editor of *Chem. & Met.*, has joined the technical publicity department of the Union Carbide & Carbon Corporation, New York City.

C. E. WILLIAMS, secretary of the United States Gypsum Co., Chicago, Ill., has been elected vice-president of the company. He will continue, as well, in his secretarial capacity.

JOSEPH WILSHIRE, heretofore vice-president of the Fleischmann Yeast Co., Chicago, Ill., has been elected acting president of the company to succeed Julius Fleischmann, deceased.

Calendar

AMERICAN CHEMICAL SOCIETY, New York Section, March 6.

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Ill., Feb. 24 to 27.

AMERICAN ELECTROCHEMICAL SOCIETY, Niagara Falls, April 23 to 25.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, semi-annual meeting, Providence-Biltmore Hotel, Providence, R. I., June 22 to 25.

AMERICAN PULP AND PAPER MILL SUPERINTENDENTS ASSOCIATION, Niagara Falls, N. Y., June 4 to 6.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 22 to 26.

CHEMICAL EQUIPMENT EXPOSITION, Association of Chemical Equipment Manufacturers, State Armory, Providence, R. I., June 22 to 27.

BRUSSELS INTERNATIONAL AND COMMERCIAL FAIR (sixth), Brussels, Belgium, March 25 to April 8.

IRON AND STEEL INSTITUTE (British), annual meeting, London, May 7 and 8.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, New York, Sept. 28 to Oct. 3.

SOCIETY OF INDUSTRIAL ENGINEERS, national convention, Hotel Winton, Cleveland, Ohio, May 6 to 8.

SOUTHERN EXPOSITION, Grand Central Palace, New York, May 11 to 23.

At a recent meeting of the Chemists Co-operative Club, Wilmington, Del., the following officers were elected for the ensuing year: JOHN E. LEE, president; EMIL J. MAURER, vice-president; WILLIAM S. DELIHAT, secretary and treasurer; and R. E. BOWMANN, faculty advisor.

At a recent meeting of the United States Pulp Producers Association, HERMAN ELSAS, of New York, was elected president for the ensuing year. J. P. HUMMEL, Hopewell, Va., was elected Eastern vice-president; D. C. EVEREST, of Rothchild, Wis., was elected Western vice-president; and O. M. PORTER, of New York, was elected secretary and treasurer. Mr. Porter is also acting in the same capacity for the American Waxed Paper Manufacturers Association.

Obituary

JOHN STEPHEN BLANK, of Winchester, Mass., well-known leather manufacturer, died on Feb. 8, at his home, aged 77 years. His early business career was spent in Boston; in 1872 he became connected with Philip Waldmyer, Winchester, manufacturer of calfskin, and in 1878 he started in the leather-finishing business on his own account. Later he organized the company of Blank Brothers, which at one time operated two leather plants. The concern has been inactive for the past 2 years. Mr. Blank is survived by his wife, two sons and two daughters.

GEORGE F. BRIGHAM, JR., president of the Commerce Petroleum Co., Tulsa, Okla., died in that city on Feb. 8, of heart disease. He was a director of the North American Car Co., Chicago, Ill., and other industrial organizations.

CHARLES GREER, of New Castle, Pa., a pioneer tinplate manufacturer, died at his home on Feb. 6, at the age of 77. With his brother George he founded what are now the Shenango and New Castle tin plate mills of the American Sheet & Tin Plate Co. Mr. Greer was also prominently identified with the establishment of the first cement mill in this section. He is survived by his wife and three children.

ALEXANDER H. KERR, organizer of the Kerr Glass Works, San Springs, Okla., and prominently identified with the glass industry, died in Los Angeles, Calif., on Feb. 9. During the war Mr. Kerr was a dollar-a-year man at Washington, D. C., acting as an assistant Secretary of Agriculture.

HAROLD M. HILLER, chemist, connected with the Western Electric Co., New York, died at his home in Brooklyn, Feb. 8, at the age of 30 years.

FRANK MARION LOPER, of New York, secretary and treasurer of the Tennessee Copper & Chemical Corporation and of the Southern Agricultural Chemical Corporation, died at his home on Feb. 10, of pneumonia. He was 42 years old. He had just returned from a trip to Ohio, and was ill but a few days. Mr. Loper was born in Alabama, and spent most of his early life in Arkansas. In 1905 he became controller of the Cerro de Pasco Mining Co., and resided thereafter for a number of years at Lima, Peru. He returned to the United States in 1912, becoming identified with several mining companies in official capacities.

CHARLES E. MCEWING, president of the McEwing & Thomas Clay Products Co., St. Louis, Mo., died at his residence on Waterman Ave. on Feb. 3, after an illness of several days. He was 56 years of age.

Dr. GUSTAVIOUS MICHAELS, of Albany, N. Y., a chemist, died at his home on Feb. 8, aged 82 years. He was born in Germany and came to the United States when 23 years of age. Later he founded the Albany Chemical Co. of Albany, N. Y.

GEORGE FREDERICK MORGAN, president of Enoch Morgan's Sons, Inc., New York, manufacturer of soaps, etc., died in his apartment at the Martinique Hotel on Feb. 6, after a long illness. He was born in New York City in 1846, and was the last surviving son of Enoch Morgan; he had been connected with the business bearing his father's name for the past 61 years, having been president since 1882. He is survived by his wife, and one son, John W. Morgan, vice-president of the company.

SAMUEL T. SIMMONDS, manager of the welfare department of the Celluloid Co., Newark, N. J., died at his home at Bloomfield, N. J., on Feb. 10, aged 72 years. His death was sudden, due to heart trouble. He had been connected with the company for the past 53 years. He is survived by his wife, a son and four daughters.

JOHN STEVENS, for the past 8 years a chemist with the New Jersey Zinc Co., died at his home in Little Gap, Pa., on Feb. 8, following a long illness, at the age of 42 years.

THOMAS L. STURTEVANT, organizer and president of the Sturtevant Mill Co., Dorcester, Mass., died at his home in Quincy, Mass., on Feb. 9, aged 84 years. He was the inventor of several machines and mills manufactured by his company. Two sons survive.

Research in Pure Science the Life-Blood of Industry

Findlay's Phase Rule an Example of Immediate Application of Pure Scientific Research to Chemical Industry

MORE attention has been paid to the application of science to practical life than to the study of pure science and cultural pursuits, is the opinion of Prof. Alexander Findlay of the University of Aberdeen, Scotland, who is visiting the United States as acting professor of chemistry at Stanford University.

"If a country is to make progress, a certain section of its scientific men must be engaged in research," he said. "Take Roentgen, for example, in discovering X-rays; his success came from a study of the pure science and adding bit by bit to his knowledge of electrical forces, but it was some one else who made the practical application of his findings. The same is true of J. J. Thompson in his work with radio.

"If, as is frequently said, America pays too much attention to the practical side of life, it is truly deplorable for American science and advancement. I have not yet had the opportunity to observe the divisions of interest."

Prof. Alexander Findlay

Professor Findlay will return to England in September, after having given courses in "The Phase Rule and Its Application" and "General Inorganic Chemistry" at Stanford during the summer quarter.

Hygroscopic Salts Used as Dust Preventive on Highways

During the last 3 years a severe test of calcium chloride and magnesium chloride as dust preventives has been made on crushed rock and gravel surfaced highways in northern California. In all, parts of 115 miles of highway have been treated. The experiments indicate that the use of hygroscopic salts is an effective method of maintaining gravel or crushed rock roads subjected to a heavy volume of traffic. The amount required depends upon the humidity of the atmosphere. The judicious use of a suitable binder for the rock surface is essential to effective results in drier atmospheres and an aid to good results in more moist atmospheres.

Market Conditions

Easier Tendency to Prices for Chemical Products

Quiet Demand for Spot Materials Results in Greater Selling Activity—Contract Deliveries Are of Good Volume

Irregular Prices for Barium Compounds — Imported Potash Alum Easier—Better Demand for Benzol—Chlorate of Potash Firm—Interest in Synthetic Sulphate of Ammonia —Jobbing Sales of Caustic Soda at Concessions — Quiet Call for Nitrate of Soda—Sulphuric Acid Holds Strong Position—Calcined Carbonate of Potash Firm — Prussiates Move Slowly

WHILE the different consuming trades are taking large quantities of chemicals on contracts, new business is described as rather inactive. Several imported chemicals have been under selling pressure as a result of the lethargy of buyers and in some cases, chemicals of domestic origin are showing an irregular tendency. Price changes for the week were within narrow limits and basic chemicals as a rule are in a fairly steady position.

The weighted index number for the week was 113.58. This represents a decline for the period, as the number stood at 113.63 a week ago. The change, while slight, is regarded as indicating a falling off in buying with shading of prices resulting from a desire of sellers to attract buyers, rather than to any change in fundamental conditions. Contract prices are being maintained and are not affected by variations in the spot market.

Interest in Calcium Arsenate

Interest in calcium arsenate has been increased as a result of recent contract business but there has been no general move to cover ahead and producers do not find much incentive to expand production as large surplus must first be worked off. It was reported last week that early indications pointed to an unusually large infestation of weevil. Some members of the cotton trade go so far as to state that they look for one of the most destructive years in the history of the boll weevil. These reports are favorable for an increased use of arsenate but so far this has not resulted in improved demand for the poison.

Producers of wood distillation chemicals have been disturbed by increasing competition from German producers of methanol. Not only has this new product cut deeply into our export trade but arrivals of foreign methanol are increasing at domestic ports. This has given rise to reports that an increase in import duty would be sought under the flexible provisions of the tariff act.

Another development of the week was found in reports from Washington that attempts again would be made to authorize the government to purchase nitrate of soda in Chile and sell it to agricultural consumers. Recent increases in price for mixed fertilizers are said to have revived the question and a bill will be introduced in the Senate to provide a revolving fund to finance such purchases.

Acids

There has been no abatement in call for sulphuric acid and consumption continues in close harmony with production. Some producers are not offering for prompt shipment because their present output is being used to fill standing orders. Call for deliveries is persistent and prices are very firm. Muriatic acid also is in a firm position. Producers have worked off surplus holdings and have sold large amounts for future delivery. Nitric acid has sold freely in recent months and sellers are able to maintain values on a steady basis. Oxalic acid has not been active as far as new business is concerned. Many consumers are covered ahead and occasional lots of imported acid have been offered at concessions in the spot market. Since the higher duty went into effect imports of oxalic have been small and spot holdings are being reduced. Formic acid has been unsettled owing to slow demand and selling pressure on the part of importers. Citric acid is quiet on spot and buyers are not showing much interest in forward positions. Tartaric acid is marking time with very little fluctuation in price and buyers not yet ready to take on large amounts.

Potashes

Bichromate of Potash—This material preserves a firm appearance with sellers reporting sales of moderate sized amounts at 8¾c. per lb. Prices show some variation according to seller and quantity with 8¾@8¾c. per lb. covering the open quotations. Inquiry is reported for fair sized amounts for export and in some cases relatively low prices are said to have been named on export business. Indian chrome ore was quoted at $21@$22 per ton c.i.f. Atlantic ports.

Carbonate of Potash—Offerings of 80-85 per cent calcined carbonate are not free and some importers quote the market as nominal. In other quarters 6c. per lb. has been asked for spot goods and shipments are held at the same figure. Calcined 96-98 per cent has been in fair demand and was offered at 6¼@6⅝c. per lb. Hydrated 80-85 per cent has sold in a moderate way at 5¼c. per lb. both spot and shipment.

Caustic Potash—Different prices have been asked for caustic potash in the spot market with 7¼@7⅝c. per lb. representing sellers' views. Shipments were available at 7¼c. per lb. Domestic caustic is held at 7¼c. per lb. and upward at works. Demand for caustic has been light.

Chlorate of Potash—Imported chlorate has found a good outlet in recent trading. Reports of probable advances in importing costs has stimulated buying of spot and prompt shipment. Sellers quote 7⅞c. per lb. for spot and shipments are held at 6¾c. per lb. Domestic chlorate is still quoted at 8¼c. per lb. at works.

Prussiate of Potash—Yellow prussiate of potash has attracted but little attention from buyers. Demand has been confined to small lots on which prices have varied according to seller. Open quotations continue on a basis of 18@19c. per lb.

Sodas

Acetate of Soda — Production costs are reported to be on a steady basis and this is reflected in the quotations of sellers who quote acetate at 5¼c. per lb. New business is not heavy but contract deliveries have been of good volume and producers are not forced to selling activity to prevent accumulation of stocks.

Caustic Soda — Reports were heard about price cutting which referred especially to sales of job lots. According to these reports sales were made under the quotation level at New England points and also in the Middle West. It was also stated that some carlot business had been done at private terms. Producers report no change in the market and state that values are on a steady basis. The contract quotation for solid 76 per cent is $3.10 per 100 lb. at works. Spot carlots are held at $3.20 per 100 at works. Export prices are $2.90@$3.10 per 100 lb., f.a.s.

Nitrate of Soda—Demand for nitrate at primary points is reported to have been small since the first of the year. Sales for the nitrate year, however, are large and current trading has not weakened values. Stocks at Chilean points at the beginning of the month

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	113.58
Last week	113.63
Feb., 1924	121.05
Feb., 1923	125.59

Irregularity in prices for alkalis combined with shading in potash, alum, epsom salts, and barium products had a lowering effect on the weighted index number.

were estimated at 855,000 tons. In domestic markets, trading in nitrate is slow as most consumers are covered for the present. Prices do not change materially and spot is held at $2.66@$2.67 per 100 lb.

Nitrite of Soda—Seasonal call is reported against contracts with an irregular demand for spot nitrite. Domestic nitrite on spot is quoted at an inside figure of 9c. per lb. and ranges upward on a quantity basis. Imported nitrite is rather firmly held and 9¼c. per lb. is said to be the inside price of sellers.

Prussiate of Soda — Buyers are not interested except when prices are in their favor and the lack of sustained inquiry holds values in an unsettled position. In some quarters 10¼c. per lb. is the lowest price quoted. On the other hand there have been reports of sales at 10c. per lb. Shipments from abroad were quoted at 10¼c. per lb. with a possibility of doing better on firm bids.

Miscellaneous Chemicals

Alum—Arrivals of potash alum from abroad have been free and prices have been irregular as some sellers were offering inducements on an ex-dock basis. It was stated that some goods changed hands under 2¾c. per lb. with 2¾@3¼c. per lb. the general quotation. Ammonia alum has been in good demand with prices at 3¼c. per lb. for lump, 3¾c. per lb. for ground, and 3¼c. per lb. for powdered. Chrome alum was quiet at 5¼c. per lb. for potash and ammonia.

Arsenic — Domestic producers are holding prices for round lots at 5¾c. per lb. with very little activity in the market. Imported arsenic remains at 5¼c. per lb. on spot but this figure is largely nominal and 5¼c. per lb. is mentioned as a possible trading basis. The market is in a waiting position but recoveries in price are not regarded as probable and predictions of lower prices are common.

Barium Carbonate — There has been an easy tone in the market for imported barium carbonate. Spot material has been offered at $52 per ton and the open quotation is generally given as $53 per ton; the lower figure is more indicative of the actual trading basis. Domestic carbonate is held at $54@$55 per ton. Barium chloride also was easy with imported available on spot at $65 per ton. Domestic chloride was unchanged at $70 per ton.

Bleaching Powder — Supplies of bleaching powder are still reported to be large. Some consumers are maintaining a policy of buying only for current needs but contract business also is reported and sellers are maintaining the contract figure at $1.90 per 100 lb. in large drums at works. Liquid chlorine has been moving freely against old orders with prices repeated at 4c. per lb. in tanks at works and 5½c. per lb. in cylinders, carlots, at works.

Lithopone — Better feeling reported among producers and prices appear to have steadied. Leading interests quote 6c. per lb., in bags, carload lots, prompt and nearby shipment.

Alcohol

Trading in denatured alcohol has been less active, but with no important change in raw materials, the schedule of prices was well maintained. Special denatured, 190 proof, in drums, held at 54@55c. per gal., carload basis, works.

During the past week several shipments of methanol arrived here from Germany. It was reported that this material could be imported at a profit, notwithstanding the existing duty. German interests have been able to undersell American producers in foreign trade in methanol. The market here was quiet and more or less nominal on the basis of 72c. per gal., in drums, on the 97 per cent grade. Pure methanol, in tank cars, held at 74c. per gal., shipment from works.

Coal-Tar Products

Buying Interest in Benzol Improves—Aniline Oil Steady—Toluol Firm—Phenol Quiet—Pyridine Unsettled

DEMAND for benzol was more active and the market closed the week in a firmer position. Distributors have disposed of most of their surplus stocks, and, with petroleum products tending toward higher levels, the outlook is encouraging. There was a good call for toluol and solvent naphtha, with offerings of spot material scanty. Buying of creosote oil in foreign markets for shipment to the United States has subsided, and this imparted an easier feeling to the situation abroad. Phenolic resin makers are absorbing the bulk of the production of phenol, and this tends to stabilize prices; trading in the open market continues quiet. There was little if any improvement in the cresylic acid situation, offerings being ample and prices unsettled. Pyridine was available in a larger way on spot and slightly lower prices were named in some quarters. Consumption of aniline oil has been holding up well since the first of the year and prices are steady, producers asking 16c. per lb., drums extra, on prompt and forward deliveries. Refined naphthalene met with a moderate gain in buying interest, but this was not reflected in any change so far as prices were concerned.

Aniline Oil and Salt — While new business was inactive, deliveries against existing contracts were normal, which supported prices in all directions. Leading makers repeated prices for aniline oil on the basis of 16c. per lb., drums extra, carload lots, f.o.b. works. Aniline oil for red was nominally unchanged at 38@40c. per lb. Aniline salt was quiet, but unchanged at 22@24c. per lb., as to quantity and seller.

Benzol — The volume of business placed was reported as satisfactory and the market closed in a fairly steady position. Holdings were reduced considerably, and, with no change in the situation at producing centers, the undertone again favors sellers. There was a fair export inquiry for benzol. First hands quote 21c. per gal. on the 90 per cent grade and 23c. per gal. on the pure, tank cars, f.o.b. works.

Beta-Naphthol — Inquiry for beta-naphthol was fair and prices held on a steady basis, producers asking from 24@25c. per lb. on the technical variety, the inside figure obtaining on round lots.

Creosote—Advices from leading foreign markets indicate that American buyers have been less active at the higher prices, and this brought out a slightly easier feeling in some quarters of the trade. While the English markets held around 7¼d. per gal., loose, works, it was reported that this figure might be shaded on a firm bid.

Cresylic Acid—Trading was slow and competition still tends to depress values. There were sellers of the 97 per cent grade at prices ranging from 59@62c. per gal., in drums, the inside figure obtaining on carload lots. On the 95 per cent grade prices were nominal around the 55c. level.

H-Acid — While several handlers offered spot goods at 70@72c. per lb., it was reported that scattered lots could have been picked up at concessions. The market was barely steady, with business restricted.

Naphthalene — Seasonal activity is expected in refined naphthalene and this supports the market. Some traders reported a moderate increase in business. Refined flake held at 5@5¼c. per lb., the outside figure prevailing in most quarters on spot as well as forward business. Chipped naphthalene was nominal at 4¼c. per lb. Crude, to import, held at 2@2¼c. per lb., c.i.f. basis.

Ortho-Nitro-Toluene — Producers have steadied in their views and the price has been revised to 14@14c. per lb.

Phenol—So far as new business was concerned the market was a quiet affair. Prices were nominally unchanged at 23@24c. per lb., as to quantity and seller. The undertone was barely steady.

Pyridine — Offerings increased and slightly lower prices were named, the market closing at $4.15@$4.20 per gal., spot and nearby delivery. The demand was quiet.

Toluol — Demand was sufficient to absorb production and this resulted in a firmer market. Prices did not change, producers offering the commercial grade on the basis of 26c. per gal., tank cars, shipment from works.

Vegetable Oils and Fats

Manila Coconut Oil Sharply Lower—Linseed and China Wood Oils Decline—Tallow and Greases Weak

COMPETITION on the selling end was even more of a factor than a week ago and the undertone was easy on both soap making and paint oils. Lower prices prevailed for coconut oil, palm oils, linseed oil, china wood oil, corn oil, tallow and greases. Price changes in cottonseed oil were unimportant and sentiment was decidedly mixed. Consumers, especially soap makers, restricted business to a minimum, believing that the supplies now in sight warrant a fairly low selling basis. Demand for linseed oil was disappointing, resale parcels depressing values. China wood oil was under severe pressure in the Pacific coast trading centers. Offerings of palm oils for shipment from Africa increased.

Cottonseed Oil—Compared with a week ago the market for refined cottonseed oil on the Produce Exchange was from 13 to 19 points net lower. Trading was not active in the option market and prices fluctuated largely in sympathy with other speculative commodity markets. Most traders were inclined to hold off pending publication of the Bureau of the Census' monthly report on cottonseed products. Sentiment was mixed, the bullish element being influenced by the high price of lard, while bears point to the large holdings of oil for which a market must be found. In the meantime consuming demand remains quiet, both for oil and lard compound. Spot prime summer yellow was nominal around 10¾@11c. per lb., in bbl. In the option market on Thursday February oil closed at 10.50c. bid and 10.75c. asked, with May at 10.94c. bid and 10.96c. asked. July settled at 11.25@11.26c. per lb. Crude oil sold as low as 8.62½c. per lb., tank cars, Texas points, but later business went through at 8.75c. In the Southeast 8¾c. was bid and 9c. asked, tank car basis, f.o.b. mills. Lard compound was easier, closing at 12¾c. per lb., a decline of ¼c. for the week. Interest centered in the statement of lard stocks in Chicago, the holdings on Feb. 15 amounting to 71,532,745 lb., which compares with 49,746,039 on Feb. 1 and 18,272,000 lb. a year ago. May lard in Chicago closed at 15.42c. per lb., which compares with 16c. per lb. the week previous.

Linseed Oil—While deliveries of oil against existing contracts were large, virtually absorbing the entire production, new business was disappointing. The recent unsettlement in seed values did not help matters any and some weak holders offered supplies at concessions. It was possible to buy prompt shipment oil at $1.12 per gal., which compares with $1.15 per gal. a week ago., in bbl., carload basis. All crushers, however, did not appear anxious to trade on the $1.12 basis. On futures crushers named prices ranging from $1.13@$1.15 per gal., carload basis. There was no important change in the flaxseed situation. Offerings of seed in the Duluth market were less numerous, due largely to the moderate recovery in grains, and prices steadied. Duluth quoted Feb. seed at $2.97 per bu., with May at $2.99 and July also at $2.99. Compared with a week ago the Duluth market was 6c. per bu. net higher. At Buenos Aires the March option settled at $2.38½ per bu., which compares with $2.45 a week ago. Several shipments of Argentine seed arrived at New York in the past week. Receipts of domestic seed at the Northwestern terminals since the beginning of the crop year amounted to 26,500,000 bu.

China Wood Oil—Trading took place in nearby oil on the basis of 12c. per lb., tank cars, Pacific coast ports, a decline of ¼c. per lb. Forced selling was given as the reason for the weakness. Inquiry improved on the decline, varnish makers showing more buying interest. In New York spot oil settled at 13¾@14c. per lb., in bbl.

Chem. & Met. Weighted Index of prices for Oils and Fats

Base = 100 for 1913-14

This week	145.57
Last week	148.33
Feb., 1924	141.05
Feb., 1923	131.71

The decline of 2.76 points in the index number was brought about by lower prices for linseed oil, coconut oil, crude cottonseed oil, china wood oil, tallow and greases.

Coconut Oil—Soap makers bought Manila oil for shipment on a bulk basis of 8¼c. per lb., c.i.f. San Francisco, a decline of ¼c. for the week. Ceylon type oil in tank cars, coast basis, was offered at 8¾c. per lb., nearby delivery. In New York bulk oil for future delivery was offered at 9¼c. per lb., without attracting buyers. Inactivity on the part of European buyers brought out much of the recent weakness in this commodity.

Corn Oil—Crude oil sold at 9⅝c. per lb., tank cars, f.o.b. point of production, Middle West. At the close 9¾c. was asked, Chicago.

Olive Oil—Denatured olive oil was offered at $1.16 per gal., in bbl., immediate delivery. Prime green olive oil foots were offered at 9½c. per lb., with the market steady.

Palm Oil—Lagos oil for shipment was easier, in sympathy with tallow, and it was possible to shade 9¼c. per lb., c.i.f. New York, on round lots. Niger oil declined to 8¾c. per lb., c.i.f. New York. Demand was quiet.

Palm Kernel Oil—The market settled at 9@9¼c. per lb., in casks, shipment from English ports.

Rapeseed Oil—Japanese oil was offered at prices ranging from 90@93c. per gal., in bbl., as to quantity and delivery.

Soya Bean Oil — The Pacific coast market was quiet and barely steady at 11c. per lb., asked, duty paid, tank cars, February shipment.

Tallow, Etc. — Last sales of extra quality tallow went through on the basis of 8¾c. per lb., ex melters' plant, a decline of ¼c. for the week. Offerings were quite numerous at this figure, especially of outside material equal in quality to city extra special. Yellow grease settled at 8@8¼c. per lb. Oleo stearine sold at 10½c. per lb.

Argentine Flaxseed Exports Fall Off Sharply

Owing to the world's shortage in food products, shipments of oilseeds from the Argentine have not been pushed to the limit since the first of the year. However, the shipments of flaxseed to date have dwindled to such an extent that traders are inclined to accept reports of a reduction in the yield and private estimates on the exportable surplus range from 32,000,000 to 40,000,000 bu. The second preliminary report of the Ministry of Agriculture places the exportable surplus from the 1924-25 crop at 46,300,000 bu.

Argentine flaxseed exports, from Jan. 1 to Feb. 13, with a comparison, follow:

	1925	1924
To United Kingdom, bu.	244,000	1,584,000
Continent, bu.	1,048,000	5,126,000
United States, bu.	1,972,000	2,424,000
On orders, bu.	208,000	1,916,000
Total	3,472,000	11,050,000

Miscellaneous Materials

Antimony — The market was strong on small spot offerings and Chinese brands advanced to 21½c. per lb. Cookson's "C" grade was nominal at 22c. per lb. Chinese needle, lump, nominal at 10c. per lb. Standard powdered needle, 200 mesh, 11½@13c. per lb. White oxide, Chinese, 99 per cent, 16@16½c. per lb.

Glycerine—Recent business in dynamite glycerine reported at 18½c. per lb., in drums, f.o.b. point of production, indicating that market has held on steady basis. In fact some holders now ask 18½c. per lb., carload basis. Chemically pure steady at 19c. per lb., in drums. Soap-lye crude, basis 80 per cent, nominal at 12½c. per lb., loose, carload lots, f.o.b. point of production.

White Lead—The decline in the price of the metal has weakened the position of the different lead pigments and there was some talk of lowering prices. However, up to the close on Thursday leading interests continued to quote standard dry white lead on the old basis of 11½c. per lb., in bbl., carload lots. Pig lead was reduced to 9.25c. per lb. during the week, a drop of ½c.

Zinc Oxide—Demand for zinc oxide has been fair and, with no important change in basic materials, prices held on a steady basis. American process, lead free, was offered by leading makers at 7⅞c. per lb., carload lots, all positions. French process held at 9⅝c. per lb. on the red seal.

Imports at the Port of New York

February 13 to February 19

ACIDS—Citric—60 bbl., Messina, Order. **Formic**—140 carboys, Rotterdam, R. W. Greeff & Co. **Oxalic**—18 csk., Rotterdam, R. W. Greeff & Co.; 34 csk., Rotterdam, Pacific Chemical Co. **Phenol**—33 dr., Hamburg, Order. **Tannic**—22 bbl., Hamburg, Order.

ACETONE OIL—6 dr., Hamburg Order; 39 dr., Hamburg, R. W. Greeff & Co.

ALCOHOL—305 csk. methyl, Rotterdam, G. W. Sheldon & Co.; 20 dr. isopropyl, Hamburg, Order; 60 csk. butyl, Rotterdam, Order; 89 csk. butyl, Rotterdam, H. A. Metz & Co.; 8 csk. do, Rotterdam, Order; 100 csk. methyl, Rotterdam, Kuttroff, Pickhardt & Co.

ALUM — 147 csk., Gothenburg, H. W. Peabody & Co.

ALUMINUM HYDROXIDE — 10 cs., Southampton, Wander & Co.

ALUMINA SULPHATE—450 bg., Rotterdam, Meteor Products Co.

ANTHRACENE — 137 csk., Hamburg, Order.

ANTIMONY—250 cs., Osaka, Mitsui & Co.

AMMONIUM CHLORIDE — 159 csk., Rotterdam, Goldschmidt Corp.

AMMONIUM NITRATE—402 csk., Hamburg, Kuttroff, Pickhardt & Co.

ANTIMONY OXIDE—100 bg., Hamburg, A. Klipstein & Co.; 11 bbl., Hamburg, Brown Bros. & Co.

ANTIMONY REGULUS — 500 cs., Hankow, Wah Chang Trading Co.; 220 cs., Shanghai, Order.

ARSENIC—624 bbl., Tampico, American Smelting & Refining Co.; 200 cs., Tokyo, Meteor Products Co.; 476 bbl., Tampico, American Smelting & Refining Co.

BARIUM NITRATE — 29 bbl., Hamburg, Roessler & Hasslacher Chemical Co.

BARIUM OXIDE—138 kegs, Rotterdam, W. A. Brown & Co.

BARYTES—20 bg., Hamburg, Seamless Rubber Co.; 433,000 kilos, Rotterdam, Chemical & Ore Corp.; 496 bg., Rotterdam, E. L. Bullock & Sons.

CAMPHOR—117 cs., Hamburg, Equitable Trust Co.; 73 cs. crude, Hong Kong, National Park Bank; 100 cs. do, Hong Kong, C. Pfizer & Co.

CHALK — 500 bg., Antwerp, Reichard-Coulston, Inc.; 2642 bg., Antwerp, National City Bank; 500 bg., Antwerp, Reichard-Coulston, Inc.; 1000 bg., Antwerp, Irving Bank-Col. Trust Co.; 850 bg., Antwerp, Order; 500 bg., Havre, Brooklyn Trust Co.; 170 csk., Bristol, H. J. Baker & Bro.

CHEMICALS—10 cs., Hamburg, Lehn & Fink; 40 cs., Hamburg, C. Nestle & Co.; 5 csk., Hamburg, Fezandie & Sperrle; 6 csk., Hamburg, Kuttroff, Pickhardt & Co.; 50 csk., Rotterdam, A. Klipstein & Co.; 229 dr, Rotterdam, Kidder, Peabody & Co.; 20 csk., Rotterdam, Roessler & Hasslacher Chemical Co.; 160 csk., Rotterdam, Order; 250 cs., Havre, Order; 200 csk., Rotterdam, Order.

CHINA CLAY—842 tons, Bristol, Moore & Munger; 25 csk., Bristol, Order.

COLORS—33 pkg. aniline, Antwerp, Sandoz Chemical Works; 12 csk. do, Antwerp, Geigy Co.; 12 csk. dry, Southampton, Sherwin-Williams Co.; 10 csk. aniline, Hamburg, Franklin Import & Export Co.; 13 csk. aniline, Havre, Geigy Co.; 3 cs. do, Havre, Carbic Color & Chemical Co.; 29 cs. bronze, Bremen, Baer Bros.; 24 cs. bronze, Bremen, L. Uhlfelder; 12 csk. bronze, Bremen, O. Hommel Co.; 33 cs. earth, Bremen, L. H. Butcher & Co.; 15 pkt. bronze, Bremen, A. W. Fenton, Inc.; 28 csk. aniline, Havre, Geigy Co., Inc; 64 pkg. do, Havre, Ciba Co.; 20 pkg., Havre, Sandoz Chemical Works.

COPPER OXIDE—50 dr., Hamburg, Lo Curto & Funk; 30 dr., Hamburg, Order.

DEXTRINE — 250 bg., Copenhagen, Stein, Hall & Co.; 250 bg., Copenhagen, Equitable Trust Co.

DIVI-DIVI—400 bg., Maracaibo, P. R. Rincones Jr. & Co.

EPSOM SALT—500 bg., Hamburg, Order.

GLYCERINE—88 csk. crude, Marseilles, Marx & Rawolle; 10 dr. crude, Antwerp, Brown Bros. & Co.; 50 dr. do, Rotterdam, Order; 36 dr, Havana, Harshaw, Fuller & Goodwin Co.

GLAUBER SALTS—175 bbl., Hamburg, Seaboard National Bank; 250 bg. and 131 bbl., Rotterdam, E. Suter & Co.

GUMS—1873 bg. copal, Antwerp, Order; 280 bg. do, Antwerp, Chase National Bank; 95 bg. do, Antwerp, W. Schall & Co.; 11 bg. do, Antwerp Order; 273 bskt. copal, Batavia, Standard Bank of South Africa; 146 bskt. do, Batavia, Fourth Street National Bank; 216 bskt. do, Batavia, W. H. Scheel; 125 bskt. do, Batavia, Kidder, Peabody & Co.; 83 bskt. do, Batavia, Catz American Corp.; 287 bskt. do, Batavia, Irving Bank-Col. Trust Co.; 270 pkg. do, Batavia, Patterson, Boardman & Knapp; 142 bskt. do, Batavia, S. Winterbourne & Co.; 100 cs. damar, Batavia, France, Campbell & Darling; 100 cs. do, Batavia, Goldman, Sachs & Co.; 200 cs. do, Batavia, Bank of the Manhattan Co.; 863 bg. copal, Batavia, Order; 281 bg. damar and 70 bg. copal, Singapore, Order; 228 bg. damar, Singapore, Brown Bros. & Co.; 100 bg. copal, Antwerp, Order.

IRON DUST—46 cs., Hamburg, Order.

IRON OXIDE—160 bg., Bristol, G. Z. Collins & Co.; 44 csk., Bristol, Order.

IRON SULPHATE—180 csk., Hamburg, Order.

LITHOPONE — 400 csk., Antwerp, B. Moore & Co.

MAGNESIUM CHLORIDE—5.06 dr. and 85 bbl., Hamburg, Order.

MANGANESE ORE — 1867 bg., Antilla, H. S. Fredmore.

MYROBALANS — 1,600 pkts, Calcutta, National City Bank; 1,600 pkts., Calcutta, Order; 3,200 pkt., Calcutta, Order.

NAPHTHALENE — 504 bg., Hamburg, Pacific Chemical Co.

OCHER—105 csk., Marseilles, Reichard-Coulston, Inc.; 292 csk., Marseilles, Order.

OILS—China Wood—451 csk., Shanghai, D. L. Moss & Co.; 150 csk., Hankow, Wah Chang Trading Co.; 100 bbl., Hankow, Am. Finance & Commerce Corp.; 200 bbl., Hankow, Mitsui & Co.; 287 bbl., Hankow, American Linseed Co.; 100 bbl., Hankow, Order; 141 bbl., Hankow, American Linseed Co.; 180 bbl., Hankow, W. R. Grace & Co.; 885 bbl., Hankow, Bingham & Co.; 493 csk., Hankow, I. R. Boody & Co.; 446 csk., Hankow, G. W. S. Patterson & Co.; 300 csk., Hankow, Order. **Cocoanut**—783 tons, (in bulk), Manila, American Linseed Co.; 1,172 tons, Manila, Philippine Refining Co. **Cod** — 300 csk., St. Johns, National Oil Products Co.; 150 csk., St. Johns, Bowring & Co.; 160 csk., St. Johns, R. Badcock & Co. **Olive foots** (sulphur oil)—1,000 bbl., Barle, Order; 100 bbl., Messina, Order. **Palm** — 235 csk., Port Harcourt, African & Eastern Trading Co.; 252 csk., Port Harcourt, Irving Bank-Col. Trust Co.; 153 csk., Hamburg, Guaranty Trust Co. **Perilla**—295 bbl., Dairen, I. R. Boody & Co. **Rapeseed** — 450 bbl., Kobe, Oriental Vegetable Oil Co.; 300 bbl., Kobe, W. R. Grace & Co. **Sardine**—500 bbl., Kobe, Procter & Gamble Co.

OILSEEDS — Castor — 3,386 bg., Pernambuco, Baker Castor Oil Co.; 5,900 bg., Pernambuco, Order; 2,550 bg., Bahia, Industrias Reunidas F. Matarazzo. **Linseed**—4,400 tons, Rosario, Spencer Kellogg & Sons.; 2,640,000 kilos, Santa Fe, Archer-Daniels-Midland Co.; 35,635 bg. and 487,496 kilos., Rosario, Archer-Daniels-Midland Co.; 19,093 bg., Buenos Aires, Order. **Sesame**—1,057 bg., Shanghai, Wah Chang Trading Co.

PHOSPHORUS—40 cs., Havre, Order.

PLUMBAGO — 88 bbl., Colombo, New York Trust Co.; 666 bg., Colombo, Brown Bros. & Co.

POTASSIUM SALTS — 620,000 kilos manure salts and 722 bg. muriate, Antwerp, Societe Comm. des Potasses d'Alsace; 200 dr. caustic, Hamburg, A. Klipstein & Co.; 1,016 bg. nitrate, Hamburg, Kutroff, Pickhardt & Co.; 3,700 bg. sulphate, Hamburg, Potash Importing Corp. of Am.; 10 cs. bromide, Hamburg, A. Hurst & Co.; 1,200 csk. chlorate, Hamburg, Seaboard National Bank.; 600 cs. do, Hamburg, Order; 2,794 bg. nitrate, Rotterdam, Kutroff, Pickhardt & Co.; 21 csk. salts, Bremen, Corn Exchange Bank; 2,550 bg. muriate, Bremen, Potash Importing Corp. of America; 333 bg. muriate, Havre, Societe Comm. des Potasses d'Alsace; 72 csk. carbonate, Hamburg, Parsons & Petit; 160 bbl. nitrate, 400 kegs. chlorate and 100 cs. bromide, Hamburg, Order; 100 csk. perchlorate, Antwerp, Meteor Products Co.; 1,016 bg., nitrate, Rotterdam, Kuttroff, Pickhardt & Co.

PYRITES — 6,192,110 kilos (in bulk), Huelva, The Pyrites Co.

QUICKSILVER — 250 flasks, Alicante, Order.

SAL AMMONIAC—100 csk., Rotterdam, Kuttroff, Pickhardt & Co.; 51 csk., Rotterdam, Order; 100 csk., Rotterdam, Order.

SHELLAC — 985 bg., Calcutta, Order; 135 bg., Calcutta, Brown Bros. & Co.; 200 bg., Calcutta, Bank of London & South Am.; 1,234 bg., Calcutta, Order.

SODIUM SALTS — 500 bg. phosphate, Marseilles, Hollinghurst & Co.; 32,114 bg. nitrate, Iquique, W. R. Grace & Co.; 167 csk. phosphate, Antwerp, Brown Bros. & Co.; 41 dr. sulphite, Hamburg, C. S. Grant & Co.; 50 bg. fluosilicate, Hamburg, Order; 15 cs. bromide, Hamburg, A. Hurst & Co.; 50 bg. fluoride, Hamburg, Jungmann & Co.; 100 csk. chlorate, Hamburg, Seaboard National Bank; 88 csk. nitrate, Oslo, Norwegian Nitrogen Co.; 50 dr. sulphite, Bristol, R. F. Downing & Co.; 125 csk. nitrate, Rotterdam, Kuttroff, Pickhardt & Co.; 30 csk. prussiate, Rotterdam, Order; 442 cs. cyanide, Havre, Anglo South-Am. Trust Co.; 5,182 bg. nitrate and 18 csk. do., Brevik, Order; 77 csk. fluoride, Bremen, Globe Shipping Co.; 221 cs. cyanide, Havre, Anglo South-Am. Trust Co; 1,660 bg. nitrate, Hamburg, Kuttroff, Pickhardt & Co.; 97 csk. phosphate, Antwerp, Order.

STRONTIUM CARBONATE — 14 csk., Hamburg, Hummel & Robinson.

SUMAC—560 bg. ground, Palermo, Order.

TALC—1,500 bg., Genoa, Italian Discount Trust Co.; 800 bg., Genoa, C. Mathieu.

TARTAR—100 bg., Marseilles, Tartar Chemical Co.; 483 bg., Marseilles, C. Pfizer & Co.; 86 bg., Alicante, Tartar Chemical Co.; 225 bg., Barcelona, Order; 186 bg., Valencia, C. Pfizer & Co.; 200 bg., Marseilles, Order.

TETRACHLORATHAN — 163 dr., Hamburg, Roessler & Hasslacher Chemical Co.

THORIUM NITRATE—10 cs., Hamburg, Pfaltz & Bauer.

VANADIUM ORE — 6,400 bg., Callao, Vanadium Corp. of Am.

WAXES—78 bg. beeswax, Havana, Order; 650 bg. montan, Hamburg, Coal & Iron National Bank; 300 bg. montan, Hamburg, Bergstrom & Co.; 80 bg. beeswax, Hamburg, Bergstrom & Co.; 60 bg., Hamburg, National Bank of Commerce; 58 bg. carnauba, Hamburg, Order; 47 bg. beeswax, Constantinople, First National Bank of Boston; 300 bg. montan, Hamburg, L. A. Salomon & Bro.; 61 bg. beeswax, Alexandria, Order; 35 bg. carnauba, Pernambuco, Elbert & Co.; 112 bg. carnauba, Bahia, Bank of London & South America; 21 bg. beeswax, Leghorn, Bank of America.

WOOL GREASE — 100 bbl., Antwerp, Kidder, Peabody Accept. Corp.; 50 bbl., Bremen, Pfaltz & Bauer.

WHITING—1,000 bg., Havre, Hammill & Gillespie, Inc.; 1,000 bg., Havre, Stanley Daggett, Inc.

ZINC OXIDE—30 bbl., Antwerp, Reichard-Coulston, Inc.; 100 bbl., Marseilles, Reichard-Coulston, Inc.; 60 bbl., Marseilles, Order.

ZIRCON—1,482 bg., Colombo, Order.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are first-hand quotations in the New York market for industrial chemicals, coal-tar products and related materials used in the industries that produce

Dyes	**Paper and Pulp**
Paint and Varnish	**Petroleum**
Ceramic Materials	**Soap**
Fertilizers	**Explosives**
Rubber	**Food Products**
Sugar	**Metal Products**

Whenever available these prices are those of the American manufacturer. If for material f.o.b. works or on a contract basis, quotations are so designated. All prices refer to large quantities in original packages.

Industrial Chemicals

Acetone, drums, works	lb.	$0.10 –	$0.11
Acetic anhydride, 85 %, dr	lb.	.36 –	.38
Acid, acetic, 28%, bbl	100 lb.	3.12 –	3.37
Acetic, 56%, bbl	100 lb.	5.85 –	6.10
Acetic, 80%, bbl	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl	100 lb.	11.01 –	11.51
Boric, bbl	lb.	.10½–	.10¾
Citric, kegs	lb.	.46 –	.46½
Formic, 85%	lb.	.10½–	.10¾
Gallic, tech	lb.	.45½–	.47
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl	lb.	.13½–	.14
22% tech., light, bbl	lb.	.06½–	.07
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½–	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl	lb.	.10½–	.10¾
Phosphoric, 50% carboys	lb.	.07½–	.07¾
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	8.50 –	9.50
Sulphuric, 60°, drums	ton	12.50 –	13.50
Sulphuric, 66°, tanks	ton	13.50 –	14.50
Sulphuric, 66°, drums	ton	17.50 –	18.50
Tannic, U.S.P., bbl	lb.	.65 –	.70
Tannic, tech., bbl	lb.	.45 –	.50
Tartaric, imp., powd., bbl	lb.	.27½–	.28
Tartaric, domestic, bbl	lb.	.29 –	.30
Tungstic, per lb	lb.	1.20 –	1.25
Alcohol, butyl, drums, wks	lb.	.27½–	.28¼
Ethyl, 190 p'f. U.S.P., bbl	gal.	4.89 –	4.93
Denatured, 190 proof No. 1, special bbl	gal.	.61 –	.....
No. 1, 190 proof, special, dr	gal.	.55 –	.....
No. 1, 188 proof, bbl	gal.	.65 –	.....
No. 1, 188 proof, dr	gal.	.58 –	.....
No. 5, 188 proof, bbl	gal.	.60 –	.....
No. 5, 188 proof, dr	gal.	.54 –	.....
Alum, ammonia, lump, bbl	lb.	.03½–	.04
Potash, lump, bbl	lb.	.02½–	.03¼
Chrome, lump, potash, bbl	lb.	.05½–	.06
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.45
Iron free, bags	lb.	2.00 –	2.10
Aqua ammonia, 26°, drums	lb.	.06½–	.06¾
Ammonia, anhydrous, cyl	lb.	.28 –	.30
Ammonium carbonate, powd., tech., casks	lb.	.12 –	.12½
Nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.25 –	3.50
Antimony oxide, white, bbl	lb.	.16 –	.16½
Arsenic, white, powd., bbl	lb.	.05½–	.05¾
Red, powd., kegs	lb.	.14½–	.15
Barium carbonate, bbl	ton	53.00 –	54.00
Chloride, bbl	ton	66.00 –	68.00
Dioxide, 88%, drums	lb.	.17½–	.18
Nitrate, casks		.07½–	.08
Blanc fixe, dry, bbl	lb.	.03½–	.03¾
Bleaching powder, f.o.b. wks., drums, contract	100 lb.	1.90 –	.....
Spot, wks., drums	100 lb.	2.00 –	2.15
Borax, bbl	lb.	.05 –	.05½
Bromine, cases	lb.	.47 –	.48
Calcium acetate, bags	100 lb.	3.00 –	3.05
Arsenate, dr	lb.	.08 –	.08½
Carbide, drums	lb.	.05 –	.05½
Chloride, fused, dr. wks	ton	21.00 –	.....
Gran. drums works	ton	27.00 –	.....
Phosphate, mono, bbl	lb.	.06½–	.07½
Carbon bisulphide, drums	lb.	.06 –	.06½
Tetrachloride, drums	lb.	.06½–	.07
Chalk, precip.—domestic, light, bbl	lb.	.04½–	.04¾
Imported, light, bbl	lb.	.04½–	.05
Chlorine, liquid, tanks, wks	lb.	.04½–	.....
Contract, tanks, wks	lb.	.04 –	.....
Cylinders, 100 lb., wks	lb.	.05½–	.07½
Cobalt, oxide, bbl	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks	ton	16.00 –	18.00
Copper carbonate, bbl	lb.	.17 –	.17½
Cyanide, drums	lb.	.49 –	.50
Oxide, kegs	lb.	.16½–	.16¾
Sulphate, dom., bbl	100 lb.	4.75 –	4.80
Imp. bbl	100 lb.	4.62½–	.....
Cream of tartar, bbl	lb.	.21 –	.21½
Epsom salt, dom., bbl	100 lb.	1.75 –	2.00
Imp., tech., bags	100 lb.	1.35 –	1.40
U.S.P., dom., bbl	100 lb.	2.10 –	2.35
Ether, U.S.P., dr concent'd	lb.	.15 –	.16
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Acetate, 99%, dr	gal.	1.08 –	1.10
Formaldehyde, 40%, bbl	lb.	.09 –	.09½
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl	lb.	.23 –	.....
Fusel oil, ref., drums	gal.	3.50 –	4.00
Crude, drums	gal.	2.60 –	2.80
Glaubers salt, wks., bags	100 lb.	1.15 –	1.40
Imp., bags	100 lb.	.85	.95
Glycerine, c. p., drums extra	lb.	.19 –	.19½
Crude 80%, loose	lb.	.12½–	.12¾
Hexamethylene, drums	lb.	.65 –	.67
Lead:			
White basic carbonate, dry, casks	lb.	$0.11½–	.....
White, basic sulphate, casks	lb.	.11 –	.....
White, in oil, kegs	lb.	.1316–	.....
Red, dry, casks	lb.	.1325–	.....
Red, in oil, kegs	lb.	.1440–	.....
Acetate, white crys., bbl	lb.	.15½–	.....
Brown, broken, casks	lb.	.14½–	.....
Arsenate, powdered, bbl	lb.	.15 –	$0.16
Lime-Hydrated, b.g., wks	ton	10.50 –	12.50
Bbl., wks	ton	18.00 –	19.00
Lump, bbl. 280	lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.12½–	.....
Lithopone, bags	lb.	.06 –	.06½
Magnesium carb., tech., bags	lb.	.07 –	.08
Methanol, 95%, drums	gal.	.70 –	.72
97%, drums	gal.	.72 –	.74
Pure, tanks	gal.	.74 –	.76
drums	gal.	.78 –	.80
bbl	gal.	.83 –	.85
Methyl-acetone, t'ks	gal.	.70 –	.....
Nickel salt, double, bbl	lb.	.10 –	.....
Single, bbl	lb.	.10½–	.....
Orange mineral, csk	lb.	.16½–	.16¾
Phosgene		.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Yellow, cases	lb.	.37½–	.40
Potassium bichromate, casks	lb.	.08½–	.08¾
Bromide, gran., bbl	lb.	.38 –	.47
Carbonate, 80–85%, calcined, casks	lb.	.06 –	.06½
Chlorate, powd	lb.	.07 –	.08½
Cyanide, drums	lb.	.47 –	.52
First sorts, cask	lb.	.08½–	.08¾
Hydroxide (caustic potash) drums	lb.	.07½–	.07¾
Iodide, cases	lb.	3.65 –	3.75
Nitrate, bbl	lb.	.06 –	.07½
Permanganate, drums	lb.	.14 –	.14½
Prussiate, red, casks	lb.	.38 –	.38½
Prussiate, yellow, casks	lb.	.18 –	.18½
Salammoniac, white, gran., casks, imported	lb.	.05½–	.06
White, gran., bbl., domestic	lb.	.07 –	.07½
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl. 100	lb.	1.20 –	1.40
Salt cake (bulk) works	ton	17.00 –	19.00
Soda ash, light 58% flat, bulk, contract 100	lb.	1.25 –	.....
bags, contract 100	lb.	1.38 –	.....
Dense, bulk, contract, basis 58% 100	lb.	1.35 –	.....
bags, contract 100	lb.	1.45 –	.....
Soda, caustic, 76%, solid, drums contract 100	lb.	3.10 –	.....
Caustic, ground and flake, contracts, dr 100	lb.	3.50 –	3.85
Caustic, solid, 76% f.a.s. N. Y. 100	lb.	2.80 –	3.05
Sodium acetate, works, bbl	lb.	.05 –	.05½
Bicarbonate, bulk 100	lb.	1.75 –	.....
Bichromate, casks	lb.	.06½–	.06¾
Bisulphate (niter cake)	ton	6.00 –	7.00
Bisulphite, powd., U.S.P., bbl	lb.	.04½–	.04¾
Bromide, bbl	lb.	.41 –	.47
Chlorate, kegs	lb.	.06½–	.06¾
Chloride long	ton	12.00 –	13.00
Cyanide, cases	lb.	.19 –	.22
Flouride, bbl	lb.	.09 –	.09½
Hyposulphite, bbl	lb.	.02½–	.02¾
Nitrite, casks	lb.	.09 –	.09½
Peroxide, powd., cases	lb.	.23 –	.27
Phosphate, dibasic, bbl	lb.	.03½–	.03¾
Prussiate, yel. bbl	lb.	.10½–	.10¾
Salicylate, drums	lb.	$0.38 –	$0.40
Silicate (40°, drums) 100	lb.	.75 –	1.16
Silicate (60°, drums) 100	lb.	1.75 –	2.00
Sulphide, fused, 60-62%, drums	lb.	.02½–	.03½
Sulphite, crys., bbl	lb.	.03½–	.03¾
Strontium nitrate, powd., bbl	lb.	.09½–	.10
Sulphur chloride, yel drums	lb.	.04½–	.05
Crude	ton	18.00 –	19.00
At mine, bulk	ton	14.00 –	16.00
Flour, bag 100	lb.	2.25 –	2.35
Dioxide, liquid, cyl	lb.	.08 –	.08½
Tin bichloride, bbl	lb.	.16 –	.....
Oxide, bbl	lb.	.61 –	.....
Crystals, bbl	lb.	.39½–	.40
Zinc carbonate, bags	lb.	.12 –	.14
Chloride, gran., bags	lb.	.06½–	.07½
Cyanide, drums	lb.	.40 –	.41
Dust bbl	lb.	.08 –	.08½
Oxide, lead free, bags	lb.	.07½–	.....
5% lead sulphate bags	lb.	.06½–	.....
French, red seal, bags	lb.	.09½–	.....
French, green seal, bags	lb.	.10½–	.....
French, white seal, bbl	lb.	.11½–	.....
Sulphate, bbl. 100	lb.	3.00 –	3.50

Coal-Tar Products

Alpha-naphthol, crude, bbl	lb.	$0.60 –	$0.62
Alpha-naphthol, ref., bbl	lb.	.85 –	.90
Alpha-naphthylamine, bbl	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.65 –	.70
Anthraquinone, 25%, drums	lb.	.65 –	.67
Benzaldehyde U.S.P., tech., drums	lb.	.69 –	.71
Benzene, pure, tanks, works	gal.	.23 –	.....
Benzene, 90%, tanks, works	gal.	.21 –	.....
Benzidine base, bbl	lb.	.75 –	.78
Benzyl chloride, ref. carboys	lb.	.35 –	.....
Benzyl chloride, tech., drums	lb.	.25 –	.....
Beta-naphthol, tech., bbl	lb.	.24 –	.25
Beta-naphthylamine, tech	lb.	.65 –	.70
Cresylic acid, 97%, drums	gal.	.59 –	.62
95-97%, drums, works	gal.	.55 –	.57
Dichlorbenzene, drums	lb.	.07 –	.08½
Dinitrobenzene, bbl	lb.	.15 –	.16
Dinitrochlorbenzene, bbl	lb.	.20 –	.21
Dinitrophenol, bbl	lb.	.35 –	.40
Dinitrotoluen, bbl	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
H-acid, bbl	lb.	.68 –	.72
Meta-phenylenediamine, bbl	lb.	.90 –	.95
Monochlorbenzene, drums	lb.	.08½–	.10
Naphthalene, flake, bbl	lb.	.05 –	.05½
Naphthionate of soda, bbl	lb.	.60 –	.65
Naphthionic acid, crude, bbl	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl	lb.	.25 –	.27
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.10 –	.11
Ortho-toluidine, bbl	lb.	.18 –	.19
Para-aminophenol, base, kegs	lb.	1.15 –	1.20
Para-dichlorbenzene, bbl	lb.	.18 –	.19
Para-nitraniline, bbl	lb.	.62 –	.68
Para-nitrotoluene, bbl	lb.	.40 –	.42
Para-phenylendiamine, bbl	lb.	1.25 –	1.35
Para-toluidine, bbl	lb.	.70 –	.75
Phenol, U.S.P., dr	lb.	.23 –	.25
Picric acid, bbl	lb.	.25 –	.26
Pitch, tanks, works	ton	27.00 –	30.00
Pyridine, imp., drums	gal.	4.15 –	4.25
Resorcinol, tech., kegs	lb.	1.30 –	1.40
Resorcinol, pure, kegs	lb.	2.00 –	2.25
R-salt, bbl	lb.	.46 –	.48
Salicylic acid, tech., bbl	lb.	.33 –	.34
Salicylic acid, U.S.P., bbl	lb.	.35 –	.....
Solvent naphtha, water-white, tanks	gal.	.24 –	.25
Crude, tanks	gal.	.21 –	.22
Sulphanilic acid, crude, bbl	lb.	.16 –	.18
Tolidine, bbl	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	.....
Toluene, drums, works	gal.	.31 –	.....
Xylidine, drums	lb.	.40 –	.42
Xylene, 5 deg.-tanks	gal.	.34 –	.36
Xylene, com., tanks	gal.	.25 –	.26

Naval Stores

Rosin B-D, bbl. 280	lb.	$8.10 –	$8.20
Rosin E-I, bbl. 280	lb.	8.10 –	8.20
Rosin K-N, bbl. 280	lb.	8.30 –	8.40
Rosin W.G.-W.W., bbl. 280	lb.	9.50 –	10.40
Turpentine, spirits of, bbl	gal.	.93½–	.....
Wood, steam dist., bbl	gal.	.82 –	.82½
Wood, dest. dist., bbl	gal.	.72 –	.73
Pine tar pitch, bbl. 200	lb.	5.75 –	6.00
Tar, kiln burned, bbl. 500	lb.	13.00 –	13.50
Rosin oil, first run, bbl	gal.	.48 –	.49
Pine tar oil, com'l	gal.	.32 –	.....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ –	$0.05
Grease, yellow, loose	lb.	08½ –	.08½
Lard oil, Extra No. 1, bbl.	gal.	.96 –	.98½
Lard compound, bbl.	lb.	.12½ –	13
Neatsfootoil, 20 deg. bbl.	gal.	1.35 –	1.37
Oleo Stearine	lb.	.10½ –	.....
Oleo oil, No. 1, bbl.	lb.	.12 –	.....
Red oil, distilled, d.p. bbl.	lb.	.11 –	.11½
Tallow, extra, loose works	lb.	08½ –	.....
Tallow oil, acidless, bbl.	gal.	.92 –	.94

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.17 –	$0.17½
Castor oil, No. 1, bbl.	lb.	.17½ –	17½
Chinawood oil, bbl.	lb.	.13½ –	.14
Coconut oil, Ceylon, bbl.	lb.	.10½ –	.....
Ceylon, tanks, N. Y.	lb.	.09½ –	.09½
Corn oil, crude, bbl.	lb.	.11½ –	.12
Crude, tanks, (f.o.b. mill)	lb.	.09¼ –	.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½ –	.09
Summer yellow, bbl.	lb.	.11 –	.11½
Linseed oil, raw, car lots, bbl.	gal.	1.15 –	.....
Raw, tank cars (dom.)	gal.	1.09 –	.....
Boiled, cars, bbl. (dom.)	gal.	1.17 –	.....
Olive oil, denatured, bbl.	gal.	1.16 –	1.18
Sulphur, (fvots) bbl.	lb.	.09½ –	.09½
Palm, Lagos, casks	lb.	.09½ –	.....
Niger, casks	lb.	.08½ –	.....
Palm kernel, bbl.	lb.	.09½ –	.....
Peanut oil, crude, tanks (mill)	lb.	.11 –	.11½
Refined, bbl.	lb.	.15½ –	.16
Perilla, bbl.	lb.	.14½ –	.14½
Rapeseed oil, refined, bbl.	gal.	.90 –	.91
Sesame, bbl.	lb.	.13½ –	.14
Soya bean (Manchurian), bbl	lb.	.12½ –	.12½
Tank, f.o.b. Pacific Coast	lb.	.11 –	.11¼

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.62 –	$0.63
Menhaden, light pressed, bbl.	gal.	.74 –	.76
White bleached, bbl.	gal.	.76 –	.78
Crude, tanks (f.o.b. factory)	gal.	.55 –	.....
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl.	gal.	.75 –	.76
Winter, bleached, bbl.	gal.	.78 –	.....

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 –	$0.55
Albumen, egg, tech, kegs	lb.	.90 –	.95
Cochineal, bags	lb.	.33 –	.35
Cutch, Borneo, bales	lb.	.04½ –	.05
Rangoon, bales	lb.	.13 –	.13½
Dextrine, corn, bags 100	lb.	4.72 –	4.77
Gum, bags 100	lb.	4.94 –	5.07
Divi-divi, bags	ton	48.00 –	50.00
Fustic, sticks	ton	30.00 –	35.00
Chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.17½ –	.18
Logwood, sticks	ton	25.00 –	26.00
Chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	175.00 –	180.00
Domestic, bags	ton	50.00 –	55.00
Starch, corn, bags 100	lb.	3.97 –	4.24

Extracts

Archil, conc., bbl.	lb.	$0.16 –	$0.19
Chestnut, 25% tannin, tanks	lb.	.01½ –	.02½
Divi-divi, 25% tannin, bbl.	lb.	.05 –	.05
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09½
Gambier, liq., 25% tannin, bbl.	lb.	.13½ –	.14
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.03½ –	.04
Hypernic, liquid, 51°, bbl.	lb.	.12 –	.13
Logwood, crys., bbl.	lb.	.14 –	.15
Liq., 51°, bbl.	lb.	.07½ –	.08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ –	.04¾
Sumac, dom., 51°, bbl.	lb.	.06½ –	.06¾

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.06½ –	$0.08½
spot, bags	lb.	.08½ –	.12
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Prussian, bbl.	lb.	.35 –	.37
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.04 –	.12
Sienna, Domestic, bbl.	lb.	.03 –	.03½
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens-Chrome, C.P.Light, bbl.	lb.	.29 –	.31
Chrome, commercial, bbl.	lb.	.11 –	.12
Paris, bulk	lb.	.21 –	.24
Reds, Carmine No. 40, tins	lb.	4.25 –	4.50
Iron oxide red, casks	lb.	.08 –	.12
Para toner, kegs	lb.	.90 –	.95
Vermilion, English, bbl.	lb.	1.40 –	1.45
Yellow, Chrome, C.P. bbls	lb.	.19½ –	.20½
Ocher, French, casks	lb.	.02 –	.05

Waxes

Beeswax, crude, Afr. bg.	lb.	$0.38 –	$0.38½
Refined, light, bags	lb.	.50 –	.52
Candellila, bags	lb.	.30 –	.31
Carnauba, No. 1, bags	lb.	.36 –	.37
No. 2, North Country, bags	lb.	.30 –	.31
No. 3, North Country, bags	lb.	.28 –	.29
Japan, cases	lb.	$0.15½ –	$0.16
Montan, crude, bags	lb.	.06 –	.06½
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.06½ –	.06¾
Crude, scale 124-126 m.p. bags	lb.	.05½ –	.....
Ref., 118-120 m.p. bags	lb.	.06½ –	.06¾
Ref., 123-125 m.p., bags	lb.	.06½ –	.06¾
Stearic acid, sgle. pressed, bags	lb.	.14 –	.....
Double pressed, bags	lb.	.14½ –	.14¾

Fertilizers

Acid phosphate, 16%, wks.	ton	$9.00 –	$9.25
Ammonium sulphate, bulk f.o.b. works 100	lb.	2.75 –	.....
Blood, dried, bulk	unit	3.75 –	3.85
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks.	unit	..... –	.....
Nitrate of soda, bags 100	lb.	2.65 –	2.67
Tankage, high grade, f.o.b. Chicago	unit	3.10 –	3.20
Phosphate rock, f.o.b. mines			
Florida pebble, 68-72%	ton	3.00 –	3.50
Tennessee, 75%	ton	6.50 –	6.75
Potassium muriate, 80%, bags	ton	34.55 –	.....
Sulphate, bags, 90%	ton	45.85 –	.....
Double manure salt, bgs.	ton	26.35 –	.....
Kainit, 14%, bgs	ton	10.25 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.35 –	0.35½
Upriver coarse	lb.	.26½ –	.27
Plantation—First latex crepe	lb.	.36 –	.....
Ribbed smoked sheets	lb.	.36 –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.08½ –	$0.10
East Indian, bold, bags	lb.	.14 –	.15
Manila, amber, bags	lb.	.14 –	.16
Damar, Batavia, cases	lb.	.28 –	.28½
Singapore, No. 1, cases	lb.	.31½ –	.32
Singapore, No. 2, cases	lb.	.21 –	.21½
Kauri, No. 1, cases	lb.	.60 –	.65
Ordinary chips, cases	lb.	.21 –	.22
Manjak, Barbados, bags	lb.	.06 –	.12

Shellac

Shellac, orange fine, bags	lb.	$0.64 –	$0.65
Orange superfine, bags	lb.	.66 –	.67
Bleached, bonedry	lb.	.71 –	.73
T. N., bags	lb.	.62 –	.63

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec sh. ton		$325.00–	$400.00
Shingle, f.o.b., Quebec sh. ton		45.00 –	50.00
Cement, f.o.b., Quebec sh. ton		15.00 –	20.00
Barytes, grd., white, f.o.b. mills, bbl. net ton		17.00 –	17.50
Grd., off-color, f.o.b., Balt net ton		13.00 –	14.00
Floated, f.o.b., St. Louis, bbl. net ton		23.00 –	24.00
Crude f.o.b. mines, bulk net ton		7.00 –	8.00
Casein, bbl., tech. lb.		13 –	14
China clay (kaolin) crude,			
No. 1, f.o.b. Ga. net ton		6.50 –	8.00
Powd., f.o.b. Ga. net ton		12.00 –	15.00
Crude, f.o.b. Va. net ton		5.50 –	7.00
Ground, f.o.b. Va. net ton		10.00 –	20.00
Imp., powd. net ton		45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C. long ton		6.50 –	7.25
No. 2 f.o.b. N.C. long ton		4.50 –	5.00
No. 1 gr'd. Me. long ton		19.00 –	20.00
No. 1 Can., f.o.b., mill, powd. long ton		25.00 –	.....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.07 –	.07½
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.13 –	.13½
Tragacanth, sorts, bags	lb.	.50 –	.55
No. 1, bags	lb.	1.15 –	1.20
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N.Y.	ton	50.00 –	55.00
Magnesite, calcined	ton	35.00 –	42.50
Pumice stone, imp., casks	lb.	.03 –	.40
Dom., lump, bbl.	lb.	.06 –	.08
Dom., ground, bbl.	lb.	.03 –	.05
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.25
Sand blast, f.o.b. Ind.	ton	2.25 –	3.50
Amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 –	.....
Glass sand, f.o.b. Ill.	ton	2.00 –	2.25
Soapstone, coarse, f.o.b., Vt., bags	ton	7.00 –	7.50
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 –	.....
200 mesh, f.o.b., Ga.	ton	7.50 –	10.00
325 mesh, f.o.b. New York, grade A	ton	14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.75 –	$3.85
Corning	bbl.	2.50 –	.....
Cabell	bbl.	2.45 –	.....
Somerset	bbl.	2.55 –	.....
Illinois	bbl.	2.12 –	.....
Indiana	bbl.	2.13 –	.....
Kansas and Okla. under 28 deg.	bbl.	1.00 –	.....
California, 35 deg. and up	bbl.	1.85 –	.....

Gasoline, Etc.

Motor gasoline steel bbls.	gal.	$0.21 –	.....
Naphtha, V. M. & P. deod, steel bbls.	gal.	.20½ –	.....
Kerosene, ref. tank wagon	gal.	.13 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.08½ –	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.34 –	$0.35
Bloomless, 30@ 31 grav.	gal.	.25 –	.....
Paraffin, pale 885 vis.	gal.	.15½ –	.16
Spindle, 200, pale	gal.	.22 –	.22½
Petrolatum, amber, bbls.	lb.	.04 –	.04½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	48–50
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	43–46
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	36–40
Magnesite brick, 9-in. straight (f.o.b. wks)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
9-in. sizes, f.o.b., Birmingham	1,000	45–47
F.o.b. Mt. Union, Pa.	1,000	40–42
Silicon carbide refract brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, ton	$200.00 –	.....
Ferrochromium, per lb. of Cr, 1-2% C. lb.	.24 –	.....
4-6% C. lb.	.11½ –	.....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid gr. ton	115.00 –	.....
Spiegeleisen, 19-21% Mn. gr. ton	32.00 –	33.00
Ferromolybdenum, 50-60% Mo, per lb. Mo. lb.	1.80 –	2.00
Ferrosilicon, 10-12% gr. ton	40.00 –	44.50
50% gr. ton	82.50 –	90.00
Ferrotungsten, 70-80% per lb. of W. lb.	.90 –	.....
Ferro-uranium, 35-50%, of U, per lb. of U. lb.	4.50 –	.....
Ferrovanadium, 30-40%, per lb. of V. lb.	3.25 –	4.00

Ores and Mineral Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	21.00 –	22.00
C.i.f. Atlantic seaboard	ton	18.50 –	24.00
Coke, fdry., f.o.b. ovens	ton	4.50 –	5.00
Coke, furnace, f.o.b. ovens	ton	3.75 –	3.85
Fluorspar, gravel, f.o.b. mines, Illinois	ton	17.50 –	18.50
Ilmenite, 52% TiO_2 Va.	lb.	.01½ –	.....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42 –	.43
Manganese ore, chemical (MnO_2)	ton	70.00 –	80.00
Molybdenite 85% MoS_2, per lb. Mo S_2, N. Y.	lb.	.60 –	.70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, Span, furnace size, c.i.f. Atl. seaport	unit	.12 –	.....
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	.....
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten ore, scheelite, 60% WO_3 and over	unit	9.50 –	9.75
Tungsten, wolframite, white, 60% WO_3	unit	9.25 –	9.50
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	12.50
Vanadium pentoxide, 76%	lb.	3.00 –	3.25
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.14½ –	$0.14¾
Aluminum, 98 to 99%	lb.	.27 –	.28
Antimony, wholesale, Chinese and Japanese	lb.	.21½ –	.21¾
Nickel, 99%	lb.	.31 –	.32
Monel metal	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.57	
Lead, New York, spot	lb.	.09¼	
Zinc, spot, New York	lb.	.07¾	
Silver (commercial)	oz.	.68½	
Cadmium	lb.	.60– .62	
Bismuth (500 lb. lots.)	lb.	1.30–1.35	
Cobalt	lb.	2.50–3.00	
Magnesium, ingots, 99%	lb.	.90–1.00	
Platinum, refined	oz.	117.00	
Mercury 75	lb.	78.50–79.50	
Tungsten powder	lb.	.95–1.00	

Industrial Developments of the Week

New Construction and Machinery Requirements in the Process Industries

Some Opportunities This Week

Alkali	Saltville, Va.
Brass	Milwaukee, Wis.
Candy	Fresno, Calif.
Chemicals	Bridgeport, Conn.
Cotton Oil	Greenville, Tex.
Distillery	Marpole, B. C.
Gas	Oakland, Calif.
Glass	Los Angeles, Calif.
Gypsium	Saltville, Va.
Leather	Los Angeles, Calif.
Paint	San Francisco, Calif.
Plywood	Hoquiam, Wash.
Plywood, glue, etc.	Contra Costa County, Calif.
Rust Proofing	St. Louis, Mo.
Salt	Crumlin, Ont.
Salt	Hutchinson, Kan.
Yeast	New Orleans, La.

This page is of value not only as a machinery market but also as an index of the general activity and growth of the industries served by Chem. & Met. The reports are gathered by our regular correspondents who are instructed to verify every detail. Requirements for new machinery will be published here free of charge.

South

Ala., Birmingham—Boll-We-Go Corporation, Atlanta, Ga., B. F. Tyler, Pres., B-M Bldg., has leased a large building at 3925-29 First Ave., North, for the manufacture of a preparation for the extermination of boll weevil.

La., New Orleans — Fleischmann Yeast Co., 419 Plum St., Cincinnati, O., is having plans prepared for the construction of a two story factory and garage on Camp and Thalia Sts., here. Estimated cost $50,000. W. C. Keenan, Globe Insurance Bldg., New Orleans, is architect.

Va., Clinchfield—Clinchfield Coal Corp., controlled by Blair & Co., 24 Broadway, New York, plans the construction of a battery of byproduct coke ovens, capacity 1,000 tons coal per day, and producing 10,000,000 cu.-ft. of gas.

Va., Saltville—Mathieson Alkali Works, is issuing $1,125,000 stock, for expansion of its plant here and also at Niagara, N. Y.

Va., Saltville—United States Gypsum Co., 205 West Monroe St., Chicago, Ill., having plans prepared for the enlargement of their plant near here. Estimated cost $5,000,000.

W. Va., Harpers Ferry—Harpers Ferry Paper Co., plans to rebuild and equip pulp plant to replace fire loss. Estimated cost $50,000.

Middle West

O., Cleveland—Tropical Oil & Paint Co. R. B. Robinett, Secy., 1246 West 70th St., awarded contract for the construction of a 1 story, 80 x 120 ft. office building and 3 story, 40 x 60 ft. factory, at 1246 West 70th St., to S. W. Emerson Co., 1836 Euclid Ave. Estimated cost $75,000.

Wis., Milwaukee—J. Topzant, 144 Oneida St., Archt., will receive bids until March 5 for the construction of a 2 story, 80 x 112 ft. factory addition on Lincoln Ave., for Roberts Brass Co., 178 Lincoln Ave. Estimated cost $60,000. Brass furnaces will be required.

Wis., Sebastopol (Sturgeon Bay P. O.)—Reynolds Preserving Co., Sturgeon Bay, W. S. Reynolds, Pres., is having plans prepared for the construction of a 1 story, 40 x 90 ft. canning factory, with septic tank, 4 large cooling tanks, 8 in wells, etc. Estimated cost $40,000.

West of Mississippi

Ia., Iowa City—State Board of Education c/o W. H. Gemmill, Secy., will receive bids until March 17th for the construction of a four story, 222 x 316 ft. medical laboratory, addition to medical building. Proudfoot, Rawson & Souers, 810 Hubbell Bldg., Des Moines, are architects.

Kan., Hutchinson—Morton Salt Co., will soon award contract for the construction of a salt mill. Private plans.

Mo., St. Louis—St. Louis Rust Proof Co., 514 South Broadway, manufacturers of rust preventing compounds, awarded contract for the construction of a 60 x 160 ft. factory, at 412 Poplar St., to Grone Construction Co., 206 Benoist Bldg.

N. M. Roswell—Gilliland Oil Co., Tulsa, Okla., plans the construction of a refinery here, with a pipe line through the Pecos Valley. Also a refinery at Albuquerque.

Okla., McAlester—McAlester Cotton Oil Co., has had preliminary plans prepared for the construction of a power house and press works, to replace fire loss. Estimated cost $50,000.

Tex., Greenville — Greenville Cotton Oil Mill plans the construction of an 80 x 200 ft. cotton oil mill. Estimated cost $100,000. Engineer not selected. P. W. Plunkett is manager.

Far West

Calif., Contra Costa County—American Plywood Co., c/o C. Rosenthal, 1536 Grove St., San Francisco, plans the construction of a factory, for the manufacture of plywood products and glue, from wool pulp. Estimated cost $40,000.

Calif., Fresno—S. Tripolitz, Fulton and Fresno Sts., plans the construction of a one or two story 80 x 100 ft. candy factory, on Railroad Ave.

Calif., Los Angeles—W. C. Hendrie Co., 340 Croker St., awarded contract for the construction of a 2 story, 55 x 100 ft. factory, for the manufacture of leather belts, East 4th St., to Hamm & Grant, Ferguson Bldg., $40,000.

Calif., Los Angeles—Thompson Glass Co., c/o W. J. Saunders, Laughlin Bldg., Los Angeles, Archt., plans the construction of a one story, 175 x 175 ft. factory, at Merrill & Stanford Aves.

Calif., Oakland—California Compressed Gas Co., 1135 Third St., awarded contract for the construction of an air compressor plant, with sludge pits and gas holder base, at Wood St. between 22nd and 24th Sts., to H. J. Christensen, 17th and Telegraph Ave., $47,500.

Calif., San Francisco—Sterling Chemical Co., Inc., Vernon, G. M. Kohler, Pres., plans the construction of a chemical factory, on the unit system, for the manufacture of kalsomine, dry colors, and cold water paints. Estimate total cost $500,000.

Nev., Reno—Crown-Wilamette Paper Co., 248 Battery St., San Francisco, Calif., is planning the construction of an evaporation unit at its plant here. Estimated cost $85,000.

Ore., Portland—Vegetable Oil Mills Co., 22nd St., plans to rebuild portion of its plant recently destroyed by fire, loss estimated at $50,000. C. A. Painton is president.

Wash., Hoquiam—Harbor Plywood Co., plans the construction of a plywood factory. Estimated cost $325,000.

Canada

B. C., Marpole—United Distilleries, Ltd., Vancouver, awarded contract for the construction of a distillery, here, to Smith Bros. & Wilson, 850 Hastings St., West, Vancouver. Estimated cost $400,000. The first unit to be constructed immediately includes a granary, distillery and fermenting building, boiler house, drying house, etc.

Ont., Crumlin—Progressive Oil & Gas Co., Imperial Bldg., Hamilton, plans to equip a salt plant here. Estimated cost $30,000.

Unverified

Mich., Detroit — Standard Peninsular Brass Works, West Warren and Walton Aves., plans the construction of an office and foundry building. H. R. Brownell is president.

O., Akron—Miller Rubber Co., South High St., has had plans completed for the construction of two additional stories, 60 x 130 ft., to one of its factory buildings.

Pa., Lawrenceville — Copper Welding Corp., Pittsburgh, has leased a one story, 80 x 100 ft. foundry at 3009 Pulaski St., here, and plans to remodel for plant.

Incorporations

State Drug Co., St. Louis, Mo., manufacture and sell drugs. $50,000. G. A. Gantz, G. A. Veninga, and W. M. Hangen, Arcade Bldg.

Edna Company, Inc., Mathews, La. sugar cane, E. F. Dickenson, L. C. Gerard.

Southern Artsilk Bleach Dye Works, Burlington, N. C., $100,000. E. W. Sweet, W. L. B. Garrison, and others.

Auto Dry Cleaning Process, Inc., Dover, Del., formula for dry cleaning autos. $200,000. (Corporation Trust Co. of Delaware).

Brisber Building and Supply Corporation, clay and brick, 100 shares, common, no par value. J. Briskman, M. M. Stember, L. M. Bramdt. (Attorney, D. Sculnick, 1123 Broadway, New York).

Childs Pulp Colors, Inc., Brooklyn, N. Y., manufacturer pulp colors, etc. 200 shares, no par value, C. W. Gaylor, 30 Broad St., C. Christian, 45 West 11th St., New York, and J. Brierly, 43 Summit St., Brooklyn. (Attorneys, Jackson, Fuller, Nash & Brophy, 30 Broad St., New York).

Thorkote Products Co., Brooklyn, N. Y., asphalt products, 2,500 shares, no par value. A. M. Maier, A. M. Honohan, F. V. Delavina. (Attorneys, Walker & Redman, 100 Broadway, New York).

National Retarder Co., Dover, Del., rough chemicals, $500,000.

Northern Lignite Products Co., Wilmington, Del., $1,000,000. (Attorney, Corporation Service Co.)

Carolina Fireproofing Co., Sanford, N. C., $250,000. I. Heckenbleckner, A. M. Webb, Charlotte.

Tennessee Bauxite Co., Chattanooga, Tenn., $100,000. J. M. Alper, 10 Early St., L. Meyer.

Moore Shank Co., Everett, Mass., leather and leather substitutes, $50,000. C. M. Moore, 43 Renwick Rd., Wakefield, A. G. Moore.

Portland Mfg. Co., Inc., Boston, Mass., hides and leather, $50,000. J. Wiehn, R. S. Chamberlain, L. Nunziato, Boston, A. Alessio, Everett.

Bria Brothers, Inc., Waterbury, Conn., perfumes and drugs, $50,000. E. Bria, L. E. Bria, 242 East Main St., J. Bria, Cesarine Bria, Waterbury.

Fairmont Dye Works, Inc., Woonsocket, R. I., 500 shares, no par value. J. E. Kelley, 70 Woodland Rd., J. R. Higgins, and P. J. Keough.

Industrial Refining Co., New York, N. Y., compounds for the prevention of corrosion, $25,000. P. Edwards, J. Ringrose, N. Brown. (Attorney, M. Leffert, 1480 Broadway).

Odorkure Sales Corporation, New York, N. Y., disinfectants, $50,000. J. V. O'Leary, R. L. Wilson, J. E. McIntyre. (Attorneys, McIntyre and O'Leary, 149 Broadway).